NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

ENHANCING TRADITIONAL CLASSROOM INSTRUCTION THROUGH COMPUTER MEDIATED COMMUNICATIONS

by

Michele L. Ruppert

March 2001

Thesis Advisor:	Douglas E. Brinkley
Associate Advisor:	William J. Haga

Approved for public release; distribution is unlimited

REPORT DOCUMENTATION PAGE			*Form Approved* *OMB No. 0704-0188*
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.			
1. AGENCY USE ONLY *(Leave blank)*	**2. REPORT DATE** March 2001	**3. REPORT TYPE AND DATES COVERED** Master's Thesis	
4. TITLE AND SUBTITLE: Title (Mix case letters) Enhancing Traditional Classroom Instruction through Computer Mediated Communications			**5. FUNDING NUMBERS**
6. AUTHOR(S) Ruppert, Michele L.			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			**8. PERFORMING ORGANIZATION REPORT NUMBER**
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			**10. SPONSORING / MONITORING AGENCY REPORT NUMBER**
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and does not reflect the official policy or position of the Department of Defense or the U.S. Government.			
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited			**12b. DISTRIBUTION CODE**

13. ABSTRACT *(maximum 200 words)*

    This thesis examines the enhancement of traditional classroom instruction through the use of computer mediated communications (CMC). It explores student and instructor involvement with the use of CMC technology. Students must interact with fellow students and the teaching faculty to learn and CMC technology will facilitate this interaction. Previous research on CMC is surveyed. The CMC climate in a graduate level course is examined. The findings indicate that CMC may improve the pedagogical course framework. Recommendations include a policy stating traditional courses will be taught with CMC technologies, traditional courses should be structured properly with both course materials and CMC technologies and a training program must be implemented for both the teaching faculty and students.

14. SUBJECT TERMS: Collaborative Learning, Collective Learning, Cooperative Learning, Computer Mediated Communication, Computer Mediated Learning, Computer Supported Collaborative Learning, Group Communication, Group Interactivity, Group Learning, Human-Computer Interaction, Learning Collaboration, Learning Interaction, Online Communication, Online Groups, Online Interactivity, Peer Group Learning, Study Circles, Syndicates, Team Learning			**15. NUMBER OF PAGES** 92
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	**18. SECURITY CLASSIFICATION OF THIS PAGE** Unclassified	**19. SECURITY CLASSIFICATION OF ABSTRACT** Unclassified	**20. LIMITATION OF ABSTRACT** UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

THIS PAGE INTENTIONALLY LEFT BLANK

ENHANCING TRADITIONAL CLASSROOM INSTRUCTION THROUGH COMPUTER MEDIATED COMMUNICATIONS

Michele L. Ruppert
Lieutenant, United States Navy
B.S., University of Florida, 1991
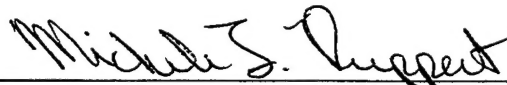M.S., Florida Institute of Technology, 1995

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN INFORMATION SYSTEMS AND TECHNOLOGY
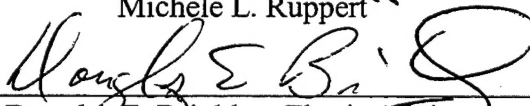
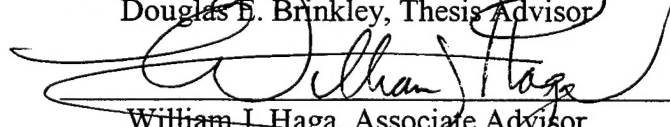from the

NAVAL POSTGRADUATE SCHOOL
March 2001

Author: _____
Michele L. Ruppert

Approved by: _____
Douglas E. Brinkley, Thesis Advisor

_____
William J. Haga, Associate Advisor

_____
Dan C. Boger, Chairman
Information Systems Academic Group

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

This thesis examines the enhancement of traditional classroom instruction through the use of computer mediated communications (CMC). It explores student and instructor involvement with the use of CMC technology. Students must interact with fellow students and the teaching faculty to learn and CMC technology will facilitate this interaction. Previous research on CMC is surveyed. The CMC climate in a graduate level course is examined. The findings indicate that CMC may improve the pedagogical course framework. Recommendations include a policy stating traditional courses will be taught with CMC technologies, traditional courses should be structured properly with both course materials and CMC technologies and a training program must be implemented for both the teaching faculty and students.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF FIGURES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TABLES

THIS PAGE INTENTIONALLY LEFT BLANK

ACKNOWLEDGEMENTS

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

A. BACKGROUND

1. What is the issue?

Research shows that computer mediated communications (CMC) can be used as a tool that enhances students' learning (Warschauer *et al.*, 1996) and encourages interaction (Folaron, 1995; Karayan and Crowe, 1997; Latting, 1994) and empowerment (Warschauer *et al.*, 1996) within a classroom.

2. What solutions does this thesis propose for this issue?

It is suggested that educational institutions establish a policy stating CMC technology will be used within the classroom, thereby allowing institutions to get involved in improving and meeting the instructional needs of the students and faculty. A planning group at educational institutions can be established that will carefully plan and evaluate the implementation and maintenance of CMC technology in order to ensure its success. Once these instructional technologies are approved at educational institutions, the faculty and students should receive detailed, periodic training on the operational use of these technologies. The faculty will need additional training to effectively implement CMC technology in their courses, and if necessary, the faculty can be compensated financially for the additional requirements of implementing of CMC. It may also be necessary to hire additional technical staff to set-up and maintain instructional technologies.

3. What will happen if this issue is not solved?

If the NPS does not consider, assess and maintain the instructional technologies used within its traditional classrooms, there is a possibility that the NPS could lose its current enrollments. By not implementing CMC in the classroom, this lack of action may degrade the student learning experience and impede students' understanding of the constantly changing computer environment in their daily lives and future assignments. Allen *et al.* (1996) report that new technology requires a continuous reassessment of what is the most effective way to teach a topic or discipline. Thereby, the NPS should keep pace with these technology developments if they are to maintain and expand current enrollments and faculty retention.

B. PURPOSE

The purpose of this thesis is to evaluate the applicability of CMC in the traditional classroom at the NPS. This thesis overviews previous research that has been conducted on this topic, examines the current CMC climate in a NPS course and obtains recommendations on how CMC can be ultimately used in the classroom. This thesis research along with the NPS senior leadership efforts to increase emphasis on reengineering the traditional classroom (Comprehensive Facilities Planning, Inc., 2000) could improve learning efficiency and effectiveness. Other potential benefits are enhanced student and faculty recruitment and retention.

II. LITERATURE REVIEW

Vygotsky (1978) stated that our interpretation of the world is derived largely from the social environment in which we experience events. Vygotsky (1978) also believes that students are transformed into independent thinkers through a social interaction process mediated by language. Social, geographic and cultural isolation can limit opportunities for feedback outside of one's own culture, thereby affecting one's interpretation of the world. Piaget (1983) argues that we construct our knowledge of the world by interacting with it. Therefore, educators must provide as broad of a collaborative learning environment as possible (Cifuentes and Murphy, 2000).

For this to be accomplished, instructors need to provide the overall structure and the parameters for a course, while the learning environment should center on the student. Students in such learner-centered environments construct their own learning within the framework of classes in attempts to make sense of their experiences. Wilson (1996) stated that this process facilitates students' creation of their own particular learning methods, ones that address their own individual needs. Thus, communication is vital for a learning environment and has been recently facilitated by CMC. Thereby, to teach is to communicate, to communicate is to interact, to interact is to learn (Hefzallah, 1999).

A. WHAT IS CMC?

CMC allows for the facilitation of an electronic collaborative conversation and interaction via distance learning or in a traditional classroom. CMC refers to any form of interpersonal communication that uses some form of computer technology to transmit,

store, annotate or present information that has been created by all participants (Wolz *et al.*, 1997). CMC allows improved learning effectiveness by freeing students from time and distance limitations and permits more equal participation in the classroom setting (Warschauer *et al.*, 1996). CMC also fosters a sense of community among students, encourages group interaction and extends discussion beyond class time (Folaron, 1995; Karayan and Crowe, 1997; Latting, 1994). Lastly, CMC facilitates and enhances student-instructor contact (D'souza, 1991, 1992; Latting, 1994) and can provide an infrastructure for policy debate (Flynn, 1987).

The application of the computer as an instrument for communication in the traditional classroom is referred to as the computer learning network (Warschauer *et al.*, 1996). Traditional classrooms connected to computer networks using CMC can communicate with any entity in the world resulting in learning across boundaries and borders. These networks take advantage of the CMC to bring together pairs and groups of students for collaborative learning projects in a single classroom or in various classrooms around the world (Warschauer *et al.*, 1996).

Software plays a key role in CMC. Computer learning networks using asynchronous and synchronous applications are a means to increase student interactions, making the students active participants in their own learning (Johnson and Hoff, 2000). These software mechanisms allow for peer editing and collaborative writing by using paperless transfer of documents within a classroom (Brandon, 1999). At the same time, these programs allow for collaborative learning where students actively communicate and contribute to and draw upon a communal, computerized database socially creating

4

knowledge (Brandon, 1999). Table 2.1 summarizes asynchronous and synchronous

applications (Gayeski, 1997):

Bandwidth	Asynchronous Applications	Synchronous Applications
Text	Email, Newsgroups and Mail List Groups, Groupware	Online Conferences, Chat Rooms, MUDs and MOOs
Graphics	Web Sites, Group Scheduling and Project Management Programs, Personal News Gathering Services	Online Whiteboard Collaboration
Audio and Video	Web Sites and FTP Sites from which you can download audio, video, program, data files	Internet Phone, Desktop Video Conferencing
Synthetic Images	VR enabled Web Sites	Online Chat Systems with Avatars

Table 2.1 Asynchronous and Synchronous Applications Table.

Asynchronous conferencing applications allow participants to collaborate at

different times (Gayeski, 1997) and permits messages to be sent from one person to many

people (Warschauer *et al.*, 1996). Gayeski (1997) defines asynchronous applications in

the following categories:

- Text:
  - E-mail uses computer text-processing and communication tools to provide

    a high-speed information exchange service. The e-mail software on a

    computer system enables one computer user to communicate with another

    user or group of users by moving text from one computer mailbox to

    another. E-mail does not require users to be logged in to the computer

    system at the same time; communication is asynchronous (or non-

    simultaneous). Individuals may post (or send) messages at any time.

5

Lastly, e-mail requires minimal computer literacy. (Johnson and Huff, 2000)

- D'souza (1992) lists the following potential educational applications of e-mail:

    - helping students understand the subject matter of a course via electronic discussions and self-help groups;

    - serving as a medium of transmission for submitting homework and returning test results;

    - bringing students together according their interests and needs.

- A listserv is an e-mail program that allows multiple computer users to connect onto a single system and have on-line discussions. Students first subscribe to the listserv via their e-mail system. When they type a message into a computer and send it to the listserv, the message is distributed automatically to all of the subscribers. Students can log on at convenient times and places (typically home, work or school computer lab) and receive all posted messages. They can choose to ignore or read each message and can choose to reply by sending a message to all subscribers or by responding only to individual members at their e-mail addresses. (Johnson and Huff, 2000)

- Newsgroups or forums allow members to post comments and questions to other newsgroup/forum members, similar to listserv.

- Groupware, usually embedded on the Internet or Intranet web sites, allows users to display sets of icons or titles of topics that contain "threads" of

back-and-forth messages. Lotus Notes is similar to using email except that everyone's responses are saved and available to be read at any time by members who have access.

- Graphics, audio, video, data:
  - o Web sites, both the Internet and organizational Intranets, are ways to share graphics, audio, video and data. The World Wide Web (WWW) is being used for educational purposes (Stocks, 2000) including the use of the Internet and Intranet web sites to collect data, to access and update database information, to request and buy materials, to complete online courses and to download files via File Transfer Protocol (FTP).

- Synthetic images:
  - o Virtual reality (VR)-enabled web sties allow for three-dimensional images to be accessed over the WWW.

In synchronous conferencing, messages are sent instantly between people who are online together (Warschauer *et al.*, 1996). Gayeski (1997) defines synchronous applications in the following categories:

- Text:
  - o Online conferences and chat rooms (i.e. ICQ Chat, AOL Instant Messenger) allows participants to sign onto a system at the same time and type messages back and forth to each other in real time.
  - o Multi-user dungeons (MUDs) and multi-user object-oriented (MOOs) programs are generally used for online games, but can be useful for interactive environments. After signing-in, a user is presented with text

7

that describes the game space. Then, the user navigates through the space by typing in commands to move or to interact with other players.

- Graphics, audio, video, data:
  - o Conferencing applications (i.e. Microsoft's NetMeeting) executed over a computer network or the Internet with two or more people. As a part of the conferencing applications, users are able to view other users' computer screens, use chat to send quick messages, share programs and transfer files and data between users. These conferencing applications simultaneously also allow users to:
    - Move objects, sketching graphics on the electronic whiteboard;
    - Type conversations via the chat mechanism;
    - Listen to real-time or recorded audio;
    - View real-time or recorded video.
- Synthetic images:
  - o Currently, most VR programs on the Internet are oriented to games and to virtual chat rooms in which the users can choose a virtual "being", called an avatar, to represent them on the screen.

B. EMPOWERMENT WITH CMC

Warschauer *et al.* (1996) studied the effect of computer learning networks on student autonomy, equality and learning skills. This is referred to as student empowerment. Warschauer *et al.* (1996) claimed that networks using CMC are excellent

tools for fostering new social relations in the classroom, resulting in greater student empowerment. For example, their research focused on the use of computer networks and CMC in the second and foreign language classrooms, but both networks and CMC have uses throughout education. So far, the prevalent forms of CMC for language teachers have been e-mail and asynchronous conferencing (Warschauer *et al.*, 1996). However, synchronous conferencing, which allows electronic discussion and collaborative writing among a classroom of students, is becoming more popular and is expected by Warschauer *et al.* (1996) to become common in second-language classrooms.

Other proponents of both single classroom and cross cultural computer learning networks have often praised their potential to improve learning effectiveness by fostering greater student autonomy and empowerment (Faigley, 1990; Batson, 1988; Barson *et al.*, 1993). Freiere (1970) claims, "Numerous educators and psychologists have tied collaborative learning to a process of empowerment." Faigley (1990) states, "Computers joined in a network can be a means of liberation, particularly for those students who are often marginalized." Batson (1988) contends, "Networks create an unusual opportunity to shift away from the traditional…because they create entirely new pedagogic dynamics." Warschauer *et al.*'s (1996) study examined three specific aspects of student empowerment: autonomy, equality and learning skills.

1. Autonomy

Educators supporting CMC believe the very nature of it encourages greater student autonomy. The asynchronicity of e-mail, for example, frees students from time and distance limitations. They can initiate discussions with their teachers or with other

9

students at any time of day, whenever they feel it is appropriate, resulting in greatly increased student-teacher and student-student interactivity (Harasim, 1986; Phillips *et al.*, 1988; Hartman *et al.*, 1991; McComb, 1993). In contrast to classroom verbal discussions, a student using CMC does not need to wait for an instructor's permission to talk, giving students even greater control over what topics to raise and when (Garrison and Baynton, 1987). Students can also communicate their thoughts at their own pace, leading to further opportunities for self-expression (Kinkead, 1987). The opportunity for students to communicate with each other, inside or outside of class, can create a new social dynamic, based on student-student collaboration, with the teacher as the facilitator (Warschauer, *et al.*, 1996). For example, a dialogue journal between a student and a teacher can easily be transformed into a collective class journal, with students sharing their thoughts, feelings, opinions and experiences with each other and the teacher stepping in to facilitate discussion as appropriate (Cohen and Miyake, 1986). Thus, the use of CMC can "prompt more discussion that is student-centered" (Selfe, 1990), "foster a sense of community" (Eldred, 1991), "encourage a sense of group knowledge" (Barker and Kemp, 1990) and help students "become active learners seeking solutions for their problems" (Boiarsky, 1990).

2. Equality

Warschauer *et al.*, (1996) found that computer networks allow more equal participation by those who are often excluded or discriminated against, including women, minorities, the disabled, shy students, students with unusual learning styles and students

who are apprehensive about writing. The three most important reasons CMC was cited for having this democratic effect were:

- It reduces social context clues related to race, gender, handicap and socio-economic status, which sometimes reinforce unequal participation in other types of interaction (Sproull and Kiesler, 1991).

- It reduces other social context cues, such as frowning and hesitating, which can intimidate people (especially those with less power and authority) by reminding them their comments are being evaluated (Finholt et al., 1986).

- It allows students to contribute at their own time and pace, neutralizing the effect of traditional classroom dynamics, which favor those who speak up most quickly, most often and are most willing to interrupt (Selfe and Meyer, 1991; Tella, 1992b).

Results of experiments have shown that CMC can allow for equal participation in the classroom. Pratt and Sullivan (1994) found that 100% of students participated in electronic discussions compared to 52% in FTF. Kern (1993) likewise found that every student participated in electronic discussions, whereas five students dominated the FTF discussions while four students did not participate at all. Kroonenberg (1995) reports, "Shy students who have refused to speak in class suddenly have fingers flying across the keyboard". She also claims that, having expressed themselves electronically, the timid students then become more willing to join in subsequent oral discussions on the same topics. Hartman *et al.* (1991) and Mabrito (1991) found that less able and more apprehensive writing students not only communicate more during electronic discussions, they also make more useful peer editing comments and end up producing better papers.

11

3. Learning Skills

Warschauer *et al.* (1996) found the final aspect of empowerment, increased learning, to be the most attractive result of network computing. This claim is based on several underlying assumptions:

- Writing helps thinking. By getting students to write their ideas, we are getting them to develop their ideas. Kroonenberg (1995) reports, "Thoughts and arguments first composed in writing on e-mail give students reflection time prior to engaging in oral work. Whenever we have a class discussion based on e-mail entries,the author find the quality of the arguments is enhanced and thinking is more creative than without this kind of preparation".

- Warschauer *et al.* (1996) stated that learning is a social activity and knowledge is socially produced. By teaching students to develop their ideas collectively, we teach them new and better ways of learning and producing knowledge. Therefore, the ability of computer networks to facilitate the sharing of ideas and writing among students is difficult to dispute (Barker and Kemp, 1990). Increased collaboration can occur not only in joint writing and peer review of documents, but in more general electronic discussion, which combines the benefits of speech (one comment can be heard by all; there can be rapid back and forth responses) and writing (more than one person can "speak" at the same time; students can benefit from composing their ideas more deliberately if they wish). In electronic discussion, a record of all comments and responses is usually easily accessible, facilitating a critical analysis of an entire collaborative discussion (McComb, 1993).

12

- We live in an age of information explosion. In the 21st century information society, knowing how to find and interpret facts is more important than memorizing them. According to Cummins and Sayers (1990), North American minority students, in particular, are held back by society-wide educational reforms emphasizing a "top-down approach" of using new technologies simply for more efficient transmission of the "basics". They claim that this approach is out of step with the cultural, scientific and economic realities of the 21st century, which demand global education, global interdependence and skill at accessing interpreting information. Cummins and Sayers (1990) contend that computer learning networks, when properly implemented, are an important tool to "facilitate a process of student empowerment and ultimately social transformation".

C. INTERACTIVITY AND COLLABORATIVE LEARNING

For educators to use CMC effectively, they should have a fundamental understanding of learning through interactivity and collaboration.

1. Learning Interaction

Borje Holmberg's theory relates the value of interaction to the quality of learning (Simonson *et al.*, 2000) by tying teaching effectiveness to the impact of feelings of belonging and cooperation as well as to the actual exchange of questions, answers and arguments. Holmberg (1989) identified seven background assumptions for this theory:

13

a. The core of teaching is interaction between the teaching and learning parties.

b. Emotional involvement in the study and feelings of personal relation between the teaching and learning parties are likely to contribute to learning pleasure.

c. Learning pleasure supports student motivation.

d. Participation in decision-making concerning the study is favorable to student motivation.

e. Strong student motivation facilitates learning.

f. A friendly, personal tone and easy access to the subject matter contribute to learning pleasure, support student motivation and thus facilitate learning from the presentations of courses, i.e., from teaching in the form of one-way traffic simulating interaction, as well as from didactic communication in the form of two-way traffic between the teaching and learning parties.

g. Students learning of what has been taught demonstrate the effectiveness of teaching.

From these assumptions, Holmberg formed his theory of the essential teaching principles for distance education. The author contends these same assumptions apply equally to the value of interaction in non-distance education environments.

Other ideas for learning through interaction have been investigated. Knowledge is neither given, nor stamped in by the impact of external stimuli; it is constructed and validated through interaction (Boyle, 1997). Learning is established and negotiated through successive turns of action and talk (Goodwin and Heritage, 1986). Learning,

14

both outside and inside school, advances through collaborative social interaction and involves making sense of experience, thought and phenomenon in context through activities such as conversation and talk (Brown *et al.*, 1989). In Brown's article, Resnick (1988) has pointed out that throughout most of their lives people learn and work collaboratively, not individually. Viewed as necessary skills in modern society, the interaction among students and between students and instructors is a valuable element of student learning, as well as the ability to work in groups (Moore, 1989). Lack of interaction among students and between students and instructors can negatively affect student learning (Brooksfield, 1987; Knowles, 1990; Meyers and Jones, 1993). Thus, the importance of learner-leaner and learner-instructor interactions cannot be understated in the traditional classroom (Brooksfield, 1987; Knowles, 1990; Meyers and Jones, 1993).

2. Learning Collaboration

Collaboration is also a critical aspect to learning (Anderson *et al.*, 1995; Roschelle and Teasley, 1995). Collaborative learning is defined as the acquisition by individuals of knowledge, skills or attitudes through group interaction in which group members share work and develop shared meanings about the group task (Derycke and D'Halluin, 1995). The idea that collaborative learning is the development of shared meaning among group members reflects the larger perspective on learning, a perspective that emphasizes the social creation of knowledge as the basis of learning. Meaning is not pre-packaged and delivered to the student for memorization; rather, it is negotiated among group members (Pea, 1994; Roschelle, 1992). The student learns through actively participating in knowledge building as a member of a group and through participation in an on-line

15

group. For example, Scardamalia and Bereiter (1996) after stating that knowledge building is the creation of knowledge as a social product, asserted that knowledge building can be encouraged by having students actively contribute to and draw upon a communal, computerized database of knowledge. The social creation of knowledge, when discussed at the level of small groups, is collaborative learning or the development of shared meaning among group members (Brandon and Hollingshead, 1999).

The collaborative development of shared meaning requires a substantial amount of communication, perhaps even more so in on-line than in FTF groups. Gay and Lentini (1995) described learning as being built through conversations between people or among groups, involving the creation and interpretation of communication. Pea (1994) and Roschelle (1992) have argued that the development of meaning does not happen independently from the social context (Pea, 1994; Roschelle, 1992). The social context in which collaboration and communication occur inherently influences learning and the on-line environment can offer a stronger sense of context than the standard classroom (Salaberry, 1996). As for the impact of CMC technology on these relations, Davies (1995) stated that learning remains a social, communicative activity, whether or not it is mediated over time and distance by communication technologies.

A substantial body of research indicates that collaborative learning can be effective in generating positive academic and affective outcomes in traditional classroom settings (Johnson *et al.*, 1991; O'Donnell and O'Kelly, 1994; Slavin, 1991). These positive outcomes are not limited to the primary and secondary levels of education. A meta-analysis of university-level and adult-learning courses found that use of collaborative learning concepts promoted higher achievement, higher-level reasoning,

16

more frequent generation of ideas and solutions and greater transfer of learning than did individualistic or competitive learning strategies (Johnson *et al.*, 1991). However, collaborative learning theory has dealt primarily with standard, classroom-based groups, not electronic groups, which raises the question of how well the benefits of collaborative learning will translate to the electronic environment. Several researchers have argued that the fusion of collaborative learning and CMC technologies is mutually beneficial, since collaborative learning helps structure the on-line environment and CMC technology removes many of the barriers to collaborative learning (Alavi, 1994; Harasim, 1991; Hooper, 1992; King, 1994). There is research that indicates that making CMC more interactive can enhance learning outcomes. Interactivity includes providing feedback (Aberson *et al.*, 1997; Azevedo, 1995; Morrison *et al.*, 1995; Svanum *et al.*, 1997) and opportunities for discussion within the CMC context (Bates *et al.*, 1996; Ross, 1996; Ruberg *et al.*, 1996). Each of these noted scholars emphasizes the value of interaction such as conversation as a key enabler of the learning process. CMC allows us to facilitate conversation and interactions electronically.

D. PITFALLS OF CMC

Though all the authors cited above were overwhelmingly positive and these authors share a sense of enthusiasm for the promise of CMC to play a greater role in improving education methodologies in the future, there are potential problems to be considered as well.

1. Costs

Primary and secondary schools are often so burdened by a lack of funding that they usually cannot afford the tools and connections needed for CMC (Berge and Collins, 1995). Many higher learning institutions are implementing computer infrastructure, but at slow pace because of equipment and installation costs (Duderstadt, 2000). Additionally, the equipment that is installed is generally outdated because the technology advances are quick (Duderstadt, 2000).

Hardware, software and maintenance investments are not trivial (Wolz *et al.*, 1997). For example, to create an interactive environment all the students need access to a computer in the classroom. Those computers must have network connectivity to communication with each other. For the students to communication with each other and the instructor, they both need the CMC software applications applicable to the course being taught. The hardware and software need to be both properly maintained to ensure optimal operability, i.e. operating system and software application upgrades, database grooms, server and personal computer backups, anti-viral signature update downloads, hardware and software repairs, system and application user accounts, additional help desk requests, etc. Therefore, colleges and universities must provide adequate facilities and support infrastructure not only for present needs but for future requirements as well.

In addition to monetary costs, there is a significant amount of time needed to use and implement CMC in the traditional classroom environment (Wolz *et al.*, 1997). Instructors must allocate their time to create the course content. The process of incorporating the course content online is as time consuming as developing the original course content itself. Also, instructors must create an effective, interactive environment

18

that empowers students to learn. The online information must also be updated frequently so that it does not become stagnant or outdated.

2. Interaction Skills

The collaborative learning environment requires a substantial amount of communication, perhaps even more so in on-line than in FTF groups. Conversely, increased reliance on computers for communications could hinder the development of or even damage existing FTF social interaction skills. Some psychologists suggest excessive involvement with computers can lead to an obsession whereby individuals become withdrawn, unresponsive and uncommunicative (Chesebro and Bonsall, 1989). FTF communication is a process in which people have the ability to convey information through body language, auditory tone and facial expressions. Even with early twenty-first century advances in video teleconferencing, most CMC systems do not present these informal messages well enough to achieve the same level of understanding (Vertegaal, 1999). The lack of these social context clues, which on one hand can encourage more free expression, can result in thoughtless, hostile or even vicious comments and other poor social behavior in on-line discussions known as "flaming" (Sproull and Kiesler, 1986; Berge 1995).

Social inequalities can manifest themselves on the computer network just as they do in the classroom. As cited in Warschauer's *et al.* (1996) report, students with dominant personalities, more computer knowledge or even just better typing skills can take advantage of the network's power to control discussions (Hiltz, 1990; Murray, 1991; Eldred, 1991). Conversely, students that do not exhibit strong reading or writing skills

19

may not be able to convey their ideas or comprehend written instructions or peoples' written interactions in an effective manner; thus, these students are not going to be able successfully interact and learn within the CMC environment. Hence, instructors should include a variety of traditional and CMC approaches to accommodate various learning styles (Wolz *et al.*, 1997).

3. Misapplications

Instructors must be trained and experienced in CMC technologies to effectively develop course material. Instructors face a substantial challenge in developing educational activities for on-line groups, which involves reconciling technological, pedagogical and student issues into an effective learning experience (Waggoner, 1992). As noted by Witmer (1998), instructors face multiple obstacles just getting students to use CMC technologies for learning purposes. Additionally, many instructors are ill-prepared to develop activities for on-line groups due to a lack of familiarity with learning in an on-line environment (Harasim, 1991), an eagerness to employ a CMC technology without due consideration of pedagogical issues (Anderson, 1996) or a lack of experience using learning groups in the standard classroom (Ahern *et al.*, 1992). Students must also be trained in the CMC technologies. They may be resistant to using the tools or become unproductively dependent upon them (Wolz *et al.*, 1997).

Sliwa (1994) suggests that instructors should resist the temptation to embrace all available technology without question. Educators are encouraged to accept only those strategies that improve the quality of learning and to carefully evaluate any technological tools they choose to use in the classroom (Johnson *et al.*, 2000). The successful diffusion

20

of an innovation throughout a social system begs the question of whether it has desirable effects (Rogers, 1983). Some studies clearly suggest that media do not influence learning under any conditions; cases show it was not the medium that caused the changes in achievement or ability, but rather a curricular reform that accompanied the change (Clark, 1983). Clark (1983) explicitly states the best evidence is that media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition. Therefore, studies are hindered by the fact that most researchers interested in the topic share a pro-innovation bias, that there is a tendency for diffusion research to side with the change agencies that promote innovations rather than with the audience of potential adopters (Rogers, 1983). Schramm (1977) claims that learning is influenced more by the content and instructional strategy in a medium than by the type of medium. Thus, the emphasis must remain on effective teaching and learning rather than solely on the technology itself (Johnson *et al.*, 2000).

4. Personal liabilities

All electronic data is traceable to the source of origin. For innovators, like instructors developing course CMC materials and students providing thought pieces, creating content in open electronic media, this data is easily accessible and can lead to personal liability issues that are beyond the CMC realm. For example, to understand the physics of bombs used on naval or shipping vessels, the instructor can create a forum to discuss bomb-making techniques for students to discuss. If this information was obtained for research or investigation, even if it was unclassified, it may to lead to criminal acts by

21

anyone who received this data. Furthermore, a comment made in a forum to stimulate discussion can be used against the person who made the comment years later even though it may not reflect his/her viewpoint. Discussion comments taken out of context can be used against individuals even though they were made in a learning environment.

III. METHODOLOGY

A. INTRODUCTION

In order to determine the usefulness of CMC, the author attended a NPS course that used CMC technology. Face-to-face (FTF), CMC and laboratory interactivity between the instructor and the students were measured. Interviews were conducted with a student focus group and the instructor to evaluate the usefulness of CMC in a traditional NPS classroom.

The NPS course, Computer Software and Technology (IS3001), incorporates CMC into its pedagogical framework. This course is one of the first courses of its kind offered at the NPS. The course web site, http://web.nps.navy.mil/~gazolla/is3001/, was used during class lectures. The web site emphasized the use of web forums.

To evaluate the effectiveness of using CMC, data were collected from three categories:

1. interaction statistics collected during a course module;

2. a student focus group session;

3. an interview with the course instructor

B. COURSE OVERVIEW

The IS3001 course syllabus (2000) provides an overview of the technology used to create modern strategic information systems: hardware architecture, operating systems, programming, software engineering and project design. The use of hands-on laboratories

23

and demonstrations provide students with an opportunity to learn how these systems work together. During the fall quarter calendar year 2000, this course was taught in two class sections. These sections met twice weekly for two-hour lectures. Generally, the second meeting of the week would be one hour of lecture and one hour of lab work.

C. OBSERVATIONS

The IS3001 class section was made up of 14 United States military, male students at the NPS. Of the 14 students, nine were in the Electrical and Computer Engineering Curriculum and five were in the Joint Command, Control, Communication, Computer and Intelligence Curriculum. IS3001 was a core requirement for the students. They were all in their first quarters of study at the NPS with little programming experience, except for one Navy student who had an undergraduate degree in computer information systems.

In the module of learning how to program with Visual Basic (VB), the FTF, CMC and lab interactivity between the students and the instructor were captured from 6 November-4 December 2000 for one of the two class sections. Forced FTF (the instructor asking students questions), unforced FTF (students voluntarily asking questions and making comments), unforced CMC (students freely using the web forum and e-mail systems to address their course and VB issues) and unforced lab (students working at their pace to complete homework assignments and projects and asking questions/making comments to the instructor and fellow classmates) interactivity statistics were obtained during the classroom lecture. The course was monitored for a total of 16.5 hours of instruction with an additional 4.5 hours of lab. Unforced CMC interactivity statistics

were obtained from the web forum and from the amount of e-mails the instructor received from students.

The author obtained FTF and lab interactivity statistics by attending classes and labs and tabulated each time students and the instructor interacted with each other. For the CMC interactivity statistics, the author also signed-on to the IS3001 website and counted the number of web forum questions by each student. The instructor also forwarded the author emails he received from students in order for the author to add to the CMC interactivity statistic. The data was maintained in a word document.

D. FOCUS GROUP WITH STUDENTS

The student focus group was designed to capture students' thoughts and explore reasons for the CMC statistics shown above. A total of three students attended this focus group voluntarily for approximately two hours. The instructor was not present so that no individual would feel reluctant to speak in front of him. The questions tailored for this group were designed to determine if CMC is useful and essential to the NPS traditional classrooms.

The focus group was held in a classroom at the NPS that contained audio-video equipment. The desks were arranged in a circle to facilitate communications. The focus group was videotaped. Appendix A includes the focus group discussion.

E. INTERVIEW WITH INSTRUCTOR

The instructor interview was designed to capture the instructor's thoughts. The interview lasted for approximately one hour. The instructor was asked the same basic questions as the students, but with additional questions about CMC development time and costs. The interview was held in the instructor's office. The interview was audiotaped. Appendix B includes the interview discussion.

IV. FINDINGS

A. OBSERVATIONS

The level of CMC interactivity was indicated by the number of e-mails students sent to the instructor and the number of questions sent to the IS3001 web forum. For the VB discussion web forum, it was left to the students' initiative to address questions and issues. It was not mandatory for the students to use. Conversely, during the introduction, computer architecture and operating systems modules, the web forum usage was mandatory. The instructor would assign each student a question. Each student had to enter the course website and web forum to obtain his question, research it and then respond. Frequently, the instructor would assign an additional follow-up question or comment on students' responses. Students from both sections could access all web forum discussions via their given computer user-id/password combination. Students could ask questions and comments on other students' questions and responses to the instructor. However, it was observed that the students did not take advantage of this opportunity during the VB and the other technical web forums. Primarily, students did not contribute greatly to these forums, because this type of participation was not a mandatory course requirement – only attendance and FTF participation during the class lecture was mandatory.

1. Interactivity Factors

The students were required to read the assignments before coming to class. The instructor ensured students interacted during class by asking questions. This was a

validation to the instructor that his students were keeping up with the materials assigned in his syllabus. It also assured the instructor that students understood the concepts discussed during class time. For unforced FTF interactions, the instructor provided open-ended questions so that students could respond freely. Most of the time, students volunteered additional questions and comments during a lecture. For unforced lab interaction, the interactivity includes only statistics when the student interacted with the instructor. Student-to-student interactivity was not included in the statistics. It was found to be too difficult to measure. Often the students worked in small groups asking questions among themselves. For unforced CMC interaction, the VB web forum and the Office E-mail system were the CMC media for which statistics were gathered.

Interactivity between the students and instructor are empirically captured as forced FTF, unforced FTF, unforced CMC and unforced lab. These measurements we refer to as interactivity factors. A total of 394 interactive events between the instructor and students were recorded. The interactivity factors statistics for the class are the following:

- FTF_Forced   86
- FTF_Unforced   232
- CMC_Unforced   4
- Lab_Unforced   72

The number of unforced interactions was 59% of the total number of interactions while the instructor forced only 22% of the interactions. The unforced lab interactions accounted for 18%. Surprisingly, the number of CMC interactions accounted for only 1% of the total number of interactions. Only two e-mails were sent to the instructor from

students requesting assistance about error messages they were receiving in their programs.

Figure 4.1 shows the interactivity statistics of the individual students. Students' interactivity levels ranged from nine to 56 with the mean participation level being at 28. On average, the level of participation seems distributed, except for students S-7 and S-8 on the high end and students S-12 and S-19 on the low end of interaction.
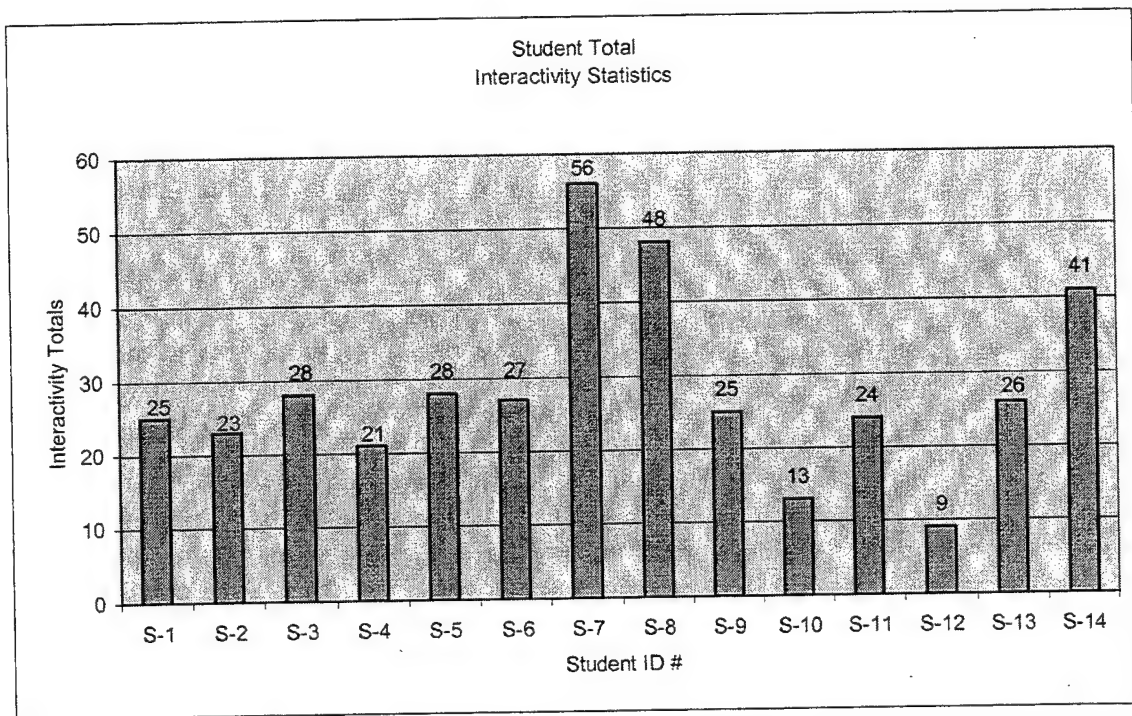

Figure 4.1 Student Total Interactivity Statistics Chart.

Each student had varying levels of participation in each of the different types of interactions offered in the class. Class attendance and participation was 10% the final course grade for each student. The students' participation levels are listed in Table 4.2.

Student ID #	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10	S-11	S-12	S-13	S-14
FTF_Forced	4	9	2	9	9	6	4	3	9	7	5	6	3	10
FTF_Unforced	14	13	21	10	13	16	40	35	10	5	12	2	19	22
CMC_Unforced	0	0	0	0	0	0	1	1	1	0	0	0	0	1
Lab_Unforced	7	1	5	2	6	5	11	9	5	1	7	1	4	8

Table 4.2 Student Individual Interactivity Statistics Table.

The mean number of FTF unforced interaction is 17. Some students did dominate (S-7, S-8), while others remained less interactive (S-10, S-12). The second highest statistic is forced FTF interactions (FTF_Forced). The instructor made 100% contact with all students. The average forced FTF interactivity points is six. The statistics show that the instructor did not call upon those students who voluntarily interacted as much as others. The lab interactivity statistic (Lab_Unforced) was the third highest statistic. However, if student-to-student interactivity were captured, this statistic by far would be the highest. To capture student-to-student interactivity was difficult because these interactions were occurring simultaneously. The CMC statistics was the lowest of all statistics, only 1% of the total interactions captured in this study. In addition, the most outspoken students were also the users of CMC. Thus, in this case, the students with lower interactivity did not utilize CMC and were not empowered by it. There are many possible explanations for this. First, since communication via CMC was optional and most student questions were answered in class, students were not compelled to use it. Second, since there were no international students for whom English is a second language, there were no students disadvantaged using oral interactions during class.

Students using English as a second language are frequently the greatest benefactors of CMC. Third, the instructor did not have the proper pedagogical training to effectively use CMC tools.

B. FOCUS GROUP WITH STUDENTS

From the students' points of view, when CMC is used correctly in the traditional classroom, it can enhance the student learning experience. The students especially like the IS3001 website because they could refer to it at any time to obtain class slides and other course material. Also, the students believed that CMC should not be used as a substitution to traditional classes. More importantly, CMC must be structured in such a way that it forces people to use CMC, which can explain its low usage in this class. It must be dynamic and the CMC content must be kept current. Depending on how well CMC is structured and maintained will directly impact the quality of the pedagogic environment of the classroom. All students believed that interaction is imperative to the learning process. Education will suffer if the interaction is not present whether it is through FTF or CMC interaction. The students concluded that courses must be designed with a proper balance of CMC usage and activities inside and outside the classroom. There is a realization that CMC activities are an extensive time sink for the students in addition to going to the classrooms to receive the instructor-student lectures. Lastly, what students learned from using CMC at the NPS will be a stepping-stone to using these products in the workplace at future commands, because many of the CMC tools are being used in the fleet. However, when you have operational groups on the move throughout

31

the world, these CMC resources have marginal gains when you compare it against the resources required to install and maintain the equipment and software in the field. Conversely, operational units in the field throughout the world can use these CMC resources to communicate with their home-based commands.

C. INTERVIEW WITH INSTRUCTOR

In the instructor's interview, he emphatically expressed that financial, training and research incentives must be provided to the NPS faculty so that CMC can slowly be incorporated into the NPS educational system. In his opinion, there is a core of faculty who continue to want to learn new technologies and techniques, while other faculty members do not want to change their teaching techniques. The instructor had a few recommendations for the NPS to implement effective CMC. First, the NPS should make a policy statement noting courses will use CMC tools in the classroom. Next, the NPS should provide training to teach the faculty the different CMC resources available for use at the NPS. Finally, they should be paid for the additional hours of learning this new material, developing and implementing a new course using CMC tools, maintaining and updating the course information from quarter to quarter and attending to students' needs.

The instructor felt the NPS faculty has several issues against using computer technology. The instructor stated some faculty fear that they may be teaching their courses online as well as teaching their courses in class, which requires more work for the same amount of pay. Therefore, these instructors are not interested in doing this type of work, because they do not get the positive feedback online like they do in class. The

feedback is very important to them. Also, the instructor declared some faculty find it is more work to teach a class online because of the preparation and development of materials than to teach it via a conventional lecture. The instructor believes labs allow students to touch things and actively work issues with the resources available. For instance in a computer lab, students tear-apart computers and piece them together as they are learning about the different components. However, the instructor does not know how can this be done online or how CMC tools can make the online environment as rich as the classroom environment. The instructor sees that students enjoy working in labs. "They learn and they develop tacit knowledge faster than just reading about it". The instructor thinks that the faculty fears that if NPS emphasized the use of distributed learning, there will be no need for the resident NPS program.

As for using CMC is his course, the instructor believes using e-mail, web forums, websites and conference software with whiteboards and chatrooms are great tools to integrate into his course. With the exception of websites, web forums and e-mail, the instructor felt he had no time to incorporate the other types of CMC mediums (i.e. chatrooms, conference software, etc.). The foremost reason was that his students had minimal experience in using communication software, except for e-mail. To get his students on similar understanding levels of web forums, the instructor provided specific mandatory training within the first week of class. If the instructor implemented more CMC mechanisms within his course, he would have to dedicate some portion of time to training his students how to use these other CMC mediums. The training time used to teach students would take away from the actual course material based on his syllabus. Furthermore, the instructor believes that web forums are good in general. However, he

33

did not think web forums were effective in the VB module of his course. The students did not see the benefit in using this forum in the classroom environment, because they knew they could use him as a primary resource to address their VB problems.

Like the focus group, the instructor stated that CMC is a definite plus in the classrooms especially using websites to post course information. Overall, he noted that depending on how the course is structured would determine what CMC tool should be used in the course. Lastly, like the students, the instructor believed what students learned from using CMC tools at the NPS could be a stepping-stone to using these products in the fleet.

V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

This exploratory study found that using CMC technologies as interaction tools in the traditional classroom is a positive enhancer to student learning. Instructors, however, need to apply appropriate teaching techniques to a given situation. Because of the high cost of developing CMC interfaces, instructors must evaluate which alternatives provide the greatest payback. To encourage the development of CMC technologies at educational institutions and reduce the costs of implementation for individual instructors, the administration should put into place an infrastructure of support to assist faculty with CMC course development. Systems should also be designed to collect and save the information gathered from web forums, chatrooms, etc. for future reference. Safeguards must also be incorporated to protect intellectual property from theft or misuse.

B. RECOMMENDATIONS

The following recommendations emerged from the in-class observations, student focus group and interview with the instructor:

- Educational institutions should make a policy statement stating courses will begin to use CMC technology in the classroom. The educational institutions should establish a planning group that includes students, faculty and other campus units to help design and implement future classrooms with instructional technologies.

35

- CMC should not be used as a substitution to traditional classes.

- CMC must be structured in such a way that entices/forces people to use it.

  o For example, to help with responsiveness to students' questions instead of waiting for a period of time for assistance (i.e. waiting for an email response or a returned telephone call), the instructor can schedule a timeframe as to when he/she will be online to answer questions and provide feedback via conference software, web forum or a chatroom.

  o Another example would be to discuss a theme related to the material being studied in class via a web forum or chatroom, but this discussion would be an hour of mandatory class time with the instructor as the facilitator of the discussion. All students must have a least one to two inputs in the discussion.

- Instructors must implement a balance between online requirements to class lectures. Generally, mandatory class lectures are up to four times weekly. Many courses include one to three hours of weekly labs. Furthermore, the student is required to visit the course website to complete assignments or to conduct other online activities. If all courses made these requirements mandatory, students will have a difficult time completing all of their course assignments. Therefore, it would be ideal to streamline the amount of lectures and increase students' personal time in reviewing course online and reference materials. Either FTF or CMC tools should be used in classes to ensure interactive environments.

- For example, instead of meeting an hour a day Monday through Thursday for lectures and Friday for one-hour lab, meet Monday for an interactive two-hour session and use Wednesday for hands-on labs and interactive sessions.

- Online course content and CMC software versions should be periodically updated.

- The teaching faculty should be compensated for the additional hours of learning new software applications in order to get their courses online and using CMC technologies, developing and implementing a new course using CMC tools, maintaining and updating the course information from quarter to quarter and attending to students' needs.

- Educational institutions should provide a training program to teach the faculty the different CMC technologies available for use on campus for their course development.

- If the workload is too tremendous on faculty members, hire additional technical staff members at the educational institutions to help install and maintain CMC software and equipment.

- Educational institutions should provide a CMC training program to students prior to starting their curriculums. This training can be conducted online prior to the students' arrival to the school or during students' indoctrination day.

- Students received a tremendous learning experience when instructors provided them an opportunity to complete a project related to their course of study. Therefore, implement virtual teams or have each of the curriculum sections be

responsible for solving real-time problems by using CMC technology and other computer and the campus resources. The implementation of resolving current problems may require that students complete less classes required for their degree. However, the gain in the learning experience may be exponentially rewarding along with resolving a problem within the fleet.

- o For example, establish a team of students with computer subspecialties to resolve the course scheduling for students and faculty members, because the system is antiquated and inflexible to the faculty and students' unique needs. To ensure that the students provide optimal recommendations and an adequate product for the educational institution, students involved in this substantial endeavor should have their course matrix reviewed and streamlined. In this manner, the students can be less stressed and provide optimal solutions to the project and also do well with courses that are truly required for their degree.

The recommendations that emerged from this study largely support what the CMC literature suggests. Proponents (D'souza, 1991, 1992; Latting, 1994; Johnson and Hoff, 2000; Warschauer *et al.*, 1996) of CMC believe that CMC is a facilitator to learning. Therefore, CMC cannot be used as a substitution to traditional classes. The NPS students and instructor along with other proponents (Wolz *et al.*, 1997; Waggoner, 1992; Witmer, 1998; Harasim, 1991; Anderson, 1996; Ahern *et al.*, 1992; Silwa, 1994; Johnson *et al.*, 2000; Schramm, 1997) of CMC state that CMC structure and its balance to course materials are keys to learning effectiveness. Therefore, instructors must be trained and experienced in the use of CMC technologies to effectively develop and teach

course materials. With this additional skill of using CMC technologies, the teaching faculty should be compensated accordingly or educational institutions should consider enlarging their technical staff to support and maintain added educational technologies. If the students are not properly trained new classroom technologies before taking courses, the instructors will initially lose momentum of teaching their course materials, because instructors are teaching their students on how to use CMC technologies before getting to the requirements of the course. Piaget (1983) believes we must interact with our world to create knowledge. By implementing virtual teams to resolve real-time problems, students will become independent thinkers and leaders of their own particular learning needs (Wilson, 1996) while at the same time working together through ubiquitous computer technologies to create new knowledge and solutions.

C. FUTURE STUDY

The use of CMC should be included in the pedagogical course framework at educational institutions. Listed below are recommendations for future studies of CMC technologies in the traditional classroom:

- Continue to monitor and evaluate courses that incorporate CMC, especially those that require students to use CMC.
- Compare courses that incorporate CMC to those that do not.
- Gather data on student performance against the effectiveness of CMC in the classroom.

- Implement a mechanism to measure student-to-student interactivity with and without CMC technologies present in the classroom.

- Test and evaluate collaboration software with different desk and computer layouts in the traditional classroom.

- Evaluate the concept of virtual teams or student groups completing real-time projects in an educational environment as a part of the degree requirements.

Continued re-evaluation of CMC in the classroom must be conducted if the NPS wants to implement CMC technologies effectively. Since CMC technologies can change quickly, the evaluation of new and effective implementation strategies should also be frequent and flexible. The computer world has changed how we conduct many facets of life and is also having a dramatic effect on the traditional classroom. Educational institutions should embrace these new technologies in classrooms in order to ensure the maximum benefit for society.

APPENDIX A. FOCUS GROUP

This is an interview between three IS3001 course students and the author. Names of individuals have been removed from this transcript. The focus group meeting as dictated from videotape:

Facilitator (F): The purpose of this focus group is to ping your thought, your ideas about using computer mediated communications in a traditional classroom environment. You have some experience with "the instructor's" class and you probably have other experiences, like in Ray's class, etc. So I want to see if I could pull ideas from you about your thoughts using computer mediated communications as a learning mechanism in getting students to interact in class. More on that in a minute.

Just to let know I am taping this session. The reason why I am doing this is because I want to get the correct interpretation of what everyone is saying. So when I do put this in my thesis, it is correct. I am also using a software package that's qualitative in nature, it's supposed to pull out themes, different themes, that people talk about, like for instance in this focus group.

All the ideas that I receive today I will incorporate into my thesis as recommendations on how to reengineer the classroom to make it better for students so they become more interactive and learn more and get more out to the courses here at the NPS. Since that's where we are going anyway especially for distance education, but we just want to focus on the traditional classroom environment. You have the instructor in the front and with the students with their computers.

What is computer mediated communications (CMC)? I put all the different types that I found into a chart in my thesis. (I explained this chart to the student volunteers, which was written on the board for the student volunteers to read. Refer to Table 2.1 and pages 4-8 for the definition and types of CMC.)

How extensively do you know how to use any these CMC products? I know everyone is familiar with e-mail and probably websites.

Student #14 (S-14): Looking at your list, I say I've used everything except for the avatars. So I am pretty familiar with everything else.

Student #4 (S-4): I'm on the other scale. I've used e-mail, websites, ftp and maybe chat rooms, but that's it.

Student #8 (S-8): I'm more familiar with the asynchronous stuff, but I've used everything in the synchronous except for the avatars. All mine has been operational content where we are actually getting stuff.

F: So you have actually used this in the working environment more than personal or both?

S-8: Yes, the work environment.

S-14: Yes, the synchronous side especially during UFL (ULCHI FOCUS LENS), a yearly exercise with the ROKN, which involves a potential invasion by NROKN.

F: This leads to my next question: How much of this is used in the Fleet and did you find it effective? Did it help you get your job done better, quicker, worse, harder?

S-8: We use it in the Fleet, but I would say it has marginal gains as when you bounce it against the resources required to set up it and install it, maintain it.

F: So it's harder to use just because of the setup?

S-8: Yes. From the Marine Corps' perspective when you are in a tactical environment, you are working with very limited bandwidth and you are working in situations that aren't as clean as you know as onboard a Naval vessel. These synchronous tools are used by primarily for commanders. They are not really tools for executors. At our pay grades, we are the guys executing plans and writing op orders and things like that. The benefit from our perspective is minimal for a lot of reasons: the lack of maturity of the systems, the inferior of the equipment we have as far as just pure communications equipment, not computer-wise, but backbone and communication equipment.

F: Telephone lines, satellites.

S-8: Yes. When you are in the field, it's a whole different world. It's an awful a lot of moving pieces just trying to get the simplest services hooked-up. You start installing the bandwidth intensive services; they usually go south in a hurry.

S-14: From my experiences at my last command, I was on a CTF Staff. We were at a fixed location at NSF Kamiseya Japan. We provided communications support to the rest of the task force. It used to be a communication facility so we had a lot of infrastructure and it has been there for years. In terms of bandwidth, it was sufficient enough. We had VTC and we were a VTC hub. We used that to tie into various conferences like with 7th Fleet or CINCPAC Fleet or something to that effect. We used I can think of two particular instances, both for UFL and in the following years we used live chat. I'll use this as an example. There was a delay with e-mail getting from any fixed location to the Blue Ridge. It would take like 6 hours in getting e-mail. You had your counterparts and your staff, the commodore and his staff waiting for information for the rest of the task force for 6 hours in length. That was unsat. Then, we found a go around by doing IP to IP type via using live chat and sending files and so forth. So it was pretty instantaneous.

F: When you did VTC was there a delay?

S-14: Yes. Our bandwidth was only 128K for VTC, but it was sufficient for any delay. The voice was pretty much real time. The frame rate was in the neighborhood of maybe 15 frames/sec. As long as people didn't move fast, it was ok.

F: Was it used for information passing and gathering at those types of sessions? If there was a problem to resolve did you use VTC to resolve those issues or was it for more for online chats for the lower levels?

S-14: For VTC we did in terms of communications stuff. The majority of the problem issues were done via regular e-mail. In terms of one-on-one with our counterparts and other staffs, it was as if they were sitting in the room with us.

S-4: In real life operations, you find that if VTC is available you will use that when there is something critical and you want to get the major players talking to each other. Before we went out to Kosovo, we used the VTC sessions with the CINC commander and the ship commander and the unit commander as well as the Navy counterparts and the Army on the shore. So it was more of hey let's see each other, let's understand where each other is coming from and let's see if we can proceed from here. As for major decisions we made with VTC, it was more for getting to know the other person's point of view visually.

F: On that train of thought, have you heard of the concept of virtual teams, where you have a group of people of 4-5 could be a lot more or less depending on what the goal is? They are there to resolve a problem and more than likely they would never see each other unless it was through one of these software packages. They would never physically meet at one location. Apparently it has been successfully done. "The instructor" gave an example about an oil refinery up north and there was a drill bit that needed to be fixed or it would be catastrophic. They beamed-in all these different factions, people to where into where this rig was and had a camera there and took pictures. All these people gave their inputs on how to fix it. Either two things could happen either it would work or it would be catastrophic. Everything work and everyone was happy.

I think in the future that commands will eventually begin to operate like this example. Do you think this would work in the in a traditional classroom setting? For instance, if an instructor structured his class into groups so that each group solved an identical problem. One group could only communicate using e-mail. Another group could only use two software packages to communicate. A third group could only physically meet once during the quarter. How effective do you think these groups would work? Do you think this is an effective way of doing business? This is more for learning in a traditional classroom environment.

S-4: The more interaction, the more learning. We learn with all our senses hearing, touch, smell, seeing, etc. Online course that do not account for that are not taking full

advantage of the learning process. Online course that supplement classroom instruction with online material is setting the benchmark for the learning process.

F: Even though we use these software packages?

S-4: Yes.

F: And you can actually see people ...

S-4: You can see and talk to people and you ask questions. Where vice with software packages, things are already slow and you might not be meeting at the right times and you are trying to hurry through it. We are not at the quite at the age, a lot of us aren't, I know I'm not, used to the practice of looking at a computer screen, to grasp really what's going on on that screen. I'm still kind of a paper-type of guy. So if it's not 3-D and face-to-face then it's a slow process, a slow learning process. It takes more time to view a screen than to than it takes a sheet of paper for me.

F: Or talking with somebody physically?

S-4: Yes.

S-14: You have something in front of you that's tangible.

S-8: In generally, I think, these tools in the classroom are only as good as the structure behind it forcing the tools. If you say, for instance in "the instructor's" class, here's the forum go broach your questions. Chances are most people aren't going to do it. The information is more accessible if they go talk to their counterpart. Now if you say all problems to the instructor will be resolved via the forums and that's the only acceptable form. Then you are forcing it to them, obviously that's what they do in distance learning. There are some definite drawbacks to distance learning as I've learned from this quarter and one of them is that you don't have the interaction. I think S-4 is absolutely right. You learn more, I do, in what I call an adult education environment, where you sit around and discuss what your experiences are based on his, what are the learning points are based on whatever topic we are talking about, etc.

F: With that being said, do all of you think CMC is only good for certain topics and not for others, certain courses and for other courses?

S-8: I think, as far as distance education goes, you gotta go with what's available. Obviously the more interaction you can have, the better off the education. I just think in general education suffers, because you don't have that interaction. It's hard to get people to do things in groups. It's hard to get timely feedback. The level of frustration is higher. First of all, you may have to type in an e-mail that three or four pages long to explain a nickel question, if you get the analogy. Or the inverse, you may have someone telling you how to build a watch instead of telling you what time it is.

44

F: So it's a matter of interpretation?

S-8: Interpretation and it's got to be structured in such a way it forces people to use it. It's got to always be dynamic. Somebody has to always manage that system. It has to be constantly updated, maintained. Those things don't run by themselves. It's a lot of work you're supporting. Of course, this would directly impact the quality of distance education.

F: It is a big issue at this school and leads to my next question. It's a provocative scenario. If an edict came from "the Admiral" and he instructed the teaching faculty to use at least two types of CMC within their classes and have them ready by the mid-point of next year, how will it be accepted or not accepted? Would it be smooth and an effective way of teaching?

S-4: I think CMC enhances the course. Don't use CMC as a substitution in the course. One of the classes I took, acquisition management, uses CMC as an enhancer. We could go online and read different articles. So the assignments required that we actually research and get some information from the sources. But it was an enhancer, because the class could have done without it.

F: And it was required for the class to go through these reading materials?

S-4: Yes.

S-8: I think there are some good things going on with the VTC and lectures. In other words, the instructors stands up and he's got students in Rhode Island or wherever and he's instructing from a central location and they are doing some things. I think, that's from a different ballpark and I think that has its applicability. From my understanding that attending the NPS is to do some courses in distance education, but the counter argument to that is hey if that is the purpose this institution then why are you bringing me here, if I have to come here and do stuff online? That's seems kind of counterproductive.

F: That's an argument being discussed at the school as well, because a lot of the faculty feels that if they have to go through all of this then why do we need the NPS? They are discussing this issue.

S-8: It's the quality of education, I think.

F: Exactly, but what I'm trying to do is stay within my thesis. We still need the students and the students must interact to learn. Even like myself, I don't talk in classes. I'm one who sits quietly in class. I don't ask questions unless it's afterwards. I generally don't ask questions during the lecture. With these online conferences and chatrooms, if the instructor set up the course to where we had 5 hours a week of classroom time with one of those hours for chatroom time, mandatory, everyone had to be there. Then the

45

instructor throws out this problem. Everyone in the room would submit their inputs. You could be known or not known, but you had to submit some type of input. Will that make me learn better? I'm not sure; I've never done it before. I would think yes, because I would have to think-out my answer, review everybody's inputs, then I would keep learning from all the other inputs and I'm learning as well to fix this problem. This is what I'm trying to work towards. Does it work in the math class? Some people think not. Some people say, yes, because you have the white board collaboration or you can do, let's say geometry with this, because you can draw a trapezoid and explain all the different calculations that go with trapezoids. How about if you taught the distributive property? It may work as well if you can write it and voice it over the system. So it may work even down to discrete type of courses. But we know that it could work with discussion courses where everybody must participate whether you like it or not. For people that are shy, they might think that's stupid because they think they learn more by listening. Just getting his or her idea out there for everyone to review is what is important. For people who are quiet, this doesn't mean that they don't want to be there or that they are not interested, maybe they are shy more than anything. Research has shown that people who are shy do have things to say, but they just have a different way of looking at things. When they do voice things, other people are like okay!

S-8: Sure, true, good points. Maybe this will be good tool for them. I think the NPS is unique. I think one assumption that they make here and I think it's a bad assumption that instructors have all the answers to the problems. Where our real life experiences, I think in many cases, bear far more weight. Because you have a guy who has never been – maybe he's been in the military, but most probably not if he has a PhD and he's trying to relate what we do for a living. Frame that however you want. I often times get into discussions with instructors because what they are discussing in class really does not relate to the military environments. I think that's a big issue here at the NPS. Some of these courses are really not as relevant like the pure math courses, calculus. But the better instructors are the guys that can relate that stuff to you in a sense that you are comfortable with whether they are talking about Fourier analysis and he's relating signals and how it goes over the radio. You are able to relate that to what you do and it hits a homerun. I think those types of relationships will be hard to do over the technology. Group chats is one thing, but you got a one-on-one instructor and the instructor has 40 questions coming to him, he's got to manage all of that.

F: Are you saying that when we using this software it's more ideal with explicit knowledge, theory and all that, than tacit knowledge? It's not good for tacit knowledge but it's good for explicit knowledge?

S-8: I would probably agree with that. But the question becomes what is the most valuable type of knowledge for those of us attending this school? Is it to learn everything about a chip or is it to learn how to properly implement it? You're the IS guy on a joint task force and what are the things that you are supposed to look out for?

S-4: Personally, I think, it's good that the school is going closer towards CMC for the majority of the classes, but again, as an enhancer. What I like to see is people attending the school. They are still in the classrooms being enhanced by the CMC. When they leave the school, they can dial back in and get some information.

F: I think that they are working towards that as one of the end results.

S-14: In effect, if they are going to have online courses using the CMC types of mediums, you take this course that typically meets four times a week not including any potential labs. If you are going to do a lot of work online, why meet four times a week? For example, I take IW where there were no meetings other than the first day and the mid-term. I even wrote this in my SOF. I made reference to the fact that it would have been good for the class to meet once a week and have the rest be supplemented online.

F: So it's kind of like the opposite of what we are doing today. If the class was structured properly online, reading the material/problems, converse with other students, but meet once a week instead of four times a week or ...

S-14: I think, the bottom line with regards to distance learning and online courses, it's suited for the right topic. It's not suited for everything and to put everything online would be a mistake.

F: What's the right topic?

S-14: Well, it depends. It would where - for things that don't require as much interaction with the instructor or as much one-on-one especially if you have groups. Groups are fine. Depending on how the online course is structured, if you have guys out in the Fleet that are also taking the course, of course, they are not going to meet in groups.

S-8: That's a good point. I mean I don't know how you are scoping your thesis, but if you are looking at how this could help the military and prove distance education, I think, one important factor you have to address just because you are providing the service does not mean the guys on the receiving end are going to able to utilize it. Because of all the reasons that you can never get anything else done while you are in the Fleet – the op tempo, you know you're killing yourself and oh by the way you have this online course that you are meeting on. I mean it has to be structured on both ends to a certain degree. There have to be parameters for the people taking the course and that there command knows that they are tied up doing this every week or whatever time and that's their job; that's what they need to be doing.

F: So for the classroom traditional environment everyone body is on the same schedule in the classroom.

S-8: Sure and I think the more you open it up to "do this" whenever and you got twelve weeks to complete this. In educational value, it diminished accordingly.

F: So it definitely needs structure.

S-4: Especially at school.

S-14: There is something inherent to human nature and it's called laziness. I don't mean laziness in the sense that there are different forms of it. Even then one man's priority is another man's. I think it's neat that I can go online and work on a course at midnight if that's what I want to do. However, I don't think they should solely based it on ...

S-8: I think S-4 has got it right. I agree with him that it should be augmented more to enhance the course.

F: So what if we went the other way and not have any CMC involved in the classrooms at all? The instructor only uses transparencies.

S-14: That's traditional teaching.

F: Yes, that is traditional teaching.

S-4: I don't think we should go back.

F: Now that we have all this good stuff.

S-4: It is good stuff, because the classroom only allows so much time. So now I'm enhancing my learning because now I can go home and go online.

F: And learn it on your own time.

S-8: Exactly. The example that you gave where the instructor says - he presents a situation that's properly framed and he let's use the resources available, the technology available to solve it. He doesn't tell you how to skin the cat, but he says here are the resources available to figure it out. That's an educational process. I use the analog that you teach a child how to jump rope and you then explain to him the proper math that is involved with jump rope. That is in its self a complete learning process. Same thing with the classroom here, you frame the problem and you let them use the resources. Not only are they going for a specific objective, but also they are getting all the knowledge that goes with finding this information with the technology available.

F: With all that being said, all this could be ideally used for any course?

S-8: Sure.

S-4: Yes. With today's technology, I think, that all courses should move in that direction to enhance their courses. So that it gives people different mediums to learn.

48

S-8: I agree.

F: Well, to be honest with you, they are looking at it. I was talking with "the instructor" yesterday. There are several packages they are looking at to ultimately install one package so instructors can start putting their courses online. This is why they have the Distributed Learning Resource Center in the library. This is strictly for the faculty to learn how to set up websites and all that other stuff.

S-8: We had course for physics where the instructor basically said we could use any resource we want to solve these problems. The learning value was significant for me because I was going out and looking at websites, looking here in the library, in physics books and doing all those other things instead of just sitting down and looking at one book, looking at one point of view. Then, what it boils down to is the quality of education has a lot to do with your emphasis and how much you do to foster it.

F: It's an individual effort.

S-8: With the quality of education that is based solely on the capability of the instructor, it's really based on your desire, dedication and interests.

F: Good point. Is there anything that you can recommend on how to better utilize CMC? I know that the instructor needs to setup the environment to where it is conducive for the students, but is there any dos and don'ts that you guys have experienced in using CMC?

S-8: Yeah, don't rely solely on that. You got to have come to some type of balance between the technology and in traditional education. You can just say here's the course with online resources and those are your grades in twelve weeks.

F: There's not any guidance is there?

S-14: Here's my forecast. My forecast is that they are going to go hard and heavy on the distance learning thing and online courses and so forth. And ultimately they are going to do a study to determine its effectiveness only to find out that it's not as effective as they thought it would be.

F: Oh, they could find the results to that in studies right now.

S-8: Maybe this would be a contradiction to some of the things I said earlier. But what's wrong with taking a group of students here in their second quarter and graduating in six quarters and basically saying here's your thesis for let's say the five of you. Here's what you are going to work on. You are going to tell us - what I'm trying to get at is use your resources at the NPS to develop tools for the Fleet. This would be a kin to having the computer science department maintain the new database, which I had to do as a final project. That's stepping out the box a little bit in traditional education, but this would be

great place to test that. So maybe they don't take quite as many courses, but they are doing something to impact the Navy and DOD and overall. I think, this adds the flexibility to do those types of things.

F: That's a good point. I think the NPS is starting to realize those potentialities.

S-8: I think that's good. I think there's a lot that can be done that's not getting done like every new course group. Let's use computer science as an example. I've been thinking about this database project. With every new group, you guys are now responsible for maintaining this product, enhance it as you go along, now and until you leave. Here's was it does. Here are the specifications. You are responsible for it 24 hours a day, 7 days a week.

S-14: You know who is going in the right direction, so far, is "the instructor" with regards to the in-class learning portion, but that the same time he supplemented his website. So if I wanted class notes that I know he will discuss in class, he had them there. He had his PowerPoint slides there. If I wanted to before hand, I could go to his website and read or print the slides. So I think that in that sense if there is a good example as to how it is being utilized in terms as an enhancement, he has learned how to use it as a good enhancement tool for students to have a source of information with regards to the material.

F: That is why we chose his class over IW or space ops. Why is the IW course so much different than what "the instructor" did? What would you do differently?

S-14: The IW course is almost completely online and there is very little interaction unless I physically go to his office or e-mail him or that sort of thing. There are forums, but you have to get into the frame of mind ...

S-8: His forums were structured in a way that he asks a question and you provide the answers. After the first six guys out of a class of 91 answering the question, there is so much you can say on any specific topic. The other thing is not only do you not have the opportunity to interact with the instructor which probably has a great deal to offer, but you don't have the opportunity necessarily to interact with other people, because there is no structure that says you have to do that. So when they say get together as a group in your cell and there are 15 people in your cell, it will never happen. What happens is one person does all the work and says here it is. Then, everyone else says roger that and sends it in. There is no structure in that.

S-14: If they did something like say a specific period for an online course, but the main course requirement is that this specific block was allocated to where students could meet so it would not interfere with other courses and anything else.

F: Make it mandatory.

S-8: Sign-in and do whatever tasks you have to do based on the online stuff. See that would work anywhere. If you had that in a distance learning course and you had six guys each at CINCPACFLT, MARFORLANT and FMFLANT, they are meeting too as long as their commands are signed up to do it and you are getting the interaction that's required.

F: Do you think there is a thing of too many people for a class to do this online stuff or does it really matter?

S-8: For the instructor, it's definitely a lot of work.

S-14: From our perspective, it doesn't make a difference.

F: On "the instructor's" site he had the web forums. If that was mandatory like for instance the bios and the hardware/software questions were mandatory. Even though these were mandatory, a lot of folks did not go to the other person's question even to read it or to even respond to it. Is there a way to make this better? I mean here's your question. You respond to it. Then he responded to it and may give you a follow-up question. You answered the follow-up question and then that would be it.

S-8: It was a one-to-one relationship.

F: It was not a conversation and he wanted you guys to converse back and forth. Maybe not so much with these questions, but definitely with the Visual Basic forum. I'm not sure if this topic was conducive enough. I just don't know.

S-14: I'm sure I was one of those guys that he wouldn't think so.

F: Well, number one was not mandatory. Number two sometimes with Visual Basic you have to see it. It's not like you are on a white board or anything. The thing we talked about yesterday is that he mentioned you had a problem and he had to see it. If you had articulated that through e-mail, it would not have been properly represented the problem you were having. It was totally different. After he reviewed your program, it was something that you would not have noticed to look out for.

S-8: Something like CMC could help with that.

F: Yes, there is an option to share programs. There are programs where I can take over your monitor. So how could the web forums be better?

S-8: To help with responsiveness to our questions instead of waiting for six hours or whatever, he could state that he would be online at these times during the weekend to answer our questions and provide feedback.

F: That's excellent. Just like the Internet newsgroups to where they schedule a chatroom for an expert at a certain time for people to come online to ask questions and make comments. For the NPS, we could have the instructor hosting the chatroom or a student with their presentation. This is a good solution for "the instructor". Anything else?

S-8: It's a tough one to crack.

F: There are so many ideas out there.

S-8: It's trial and error.

S-14: I alluded on this before, but it's got to be appropriate in the right place and context. There are some things not appropriate with NetMeeting. Plus, it's based on current technology like we have a lot of things now, but we have problems with not enough bandwidth. If everyone had T1 lines coming into their house where they could sit there with their little cameras and watch the instructor and it was real time, but that's still far down the road.

F: However, if everyone had T1 lines, then that might get bugged-up!

S-8: How far is the education at this institution willing to go if we are really dedicated to this? For those reasons you mention on technology, who makes that determination when a guy checks-in and he gets his own laptop computer? So you know he has these capabilities to do all those things. Talk about standardization and structure. I can't work at home because I'm competing with my kids and my wife to get on the computer I have. I have to come here to do all my work. When they are not playing their games, my wife is e-mailing everybody and her brother. So ...

F: That's a really good point. How could the NPS really get this started to ensure that students are properly trained for class?

S-8: Maybe it's the first day of class. "The instructor" says I don't care what you got at home, but these are configured to dial-in specifically for this purpose. You can use them at these times and for this reason. Maybe an example would just be at 1000 on Thursday we'll meet in the chatroom. I will pick someone to run their program so we can all review it and critic it.

F: That's that structure again.

S-14: Seems like it keeps alluding back to structure.

F: One of the things I was going to recommend is that you know that we have the refresher quarter or half quarter and orientation week. In my refresher half quarter, I had to take 2 courses: One course was a calculus review course, which I had to take another calculus review class again as a part of my course load about three quarters later. The

52

other course was just an intro computer class that I could have fit in to my "official" course schedule. So essentially, for me, my refresher period could have been used more effectively. Even though all refresher quarters are unique to each student and the orientation schedule is basically the same for everyone, my suggestion is to offer a course reviewing all CMC software (distributing if necessary) that the school uses in its courses during the refresher. Then, during schedule a follow-up day sometime during the orientation schedule. This way when students are moving in, settling down, they can have the opportunity to use these software packages before starting their official curriculum. The school is looking at different packages. If the school agrees to use NetMeeting as on of its CMC software applications, then teach the students how to use NetMeeting, for an example, to where they can use it at home and get that setup like they do for the Office e-mail system.

S-14: That would have to be a give-and-take situation. I had the twelve-week refresher quarter last quarter. I felt like I was busier last quarter, with three classes, than this quarter with five courses. Last quarter if I was trying to learn all those other things not knowing or having the system background, I wouldn't had enough time.

F: With my refresher quarter, one class was not necessary because I did the class again later in my third quarter, I think. The other course I could have incorporated into one of my other quarters or I could have validated it if I even tried. Essentially, I didn't really need the refresher period except for only to move and settle-in. With other curriculums it is probably imperative for them to have refresher quarters.

S-14: All that refresher quarter did for me is to get me in the study mode again.

F: I need to present this to where this type of training does not conflict with curriculums' refreshers.

S-8: I think, the refresher quarter needs to be reviewed in its entirety anyway. There are a lot of things that can be fixed.

F: They can do like during student indoctrination like maybe a week to go through all the CMC stuff for them to get familiar with these applications.

S-8: Maybe make that prerequisite by the time they get here they need to know how to do this. Here are the websites and when you get here, you better know how do NetMeeting and whatever the other tickets are.

F: Just getting the faculty trained is the other part of this and it's the hard one.

S-8: My recommendation is that I think there is so much untapped potential here at this school. You take a group of students and say this is what you are going to do; you are not going to be taking these two classes, but this is what you are going to work on during these two quarters and during this time this is the product we want to see at the end. Just

tremendous potential. We are thinking about using all this, but think about how we are thinking about applying it. We are thinking about applying all this stuff in the traditional educational sense. Why not step out of the box and apply this stuff in the completely new educational system? Where we are giving the guys a problem and let them figure out what they need to learn along the way to resolve it.

F: Great recommendation! Any other comments?

S-8, S-14: No.

F: Then, this concludes our focus group. Thanks for doing this.

S-8: I hope this was of some help.

F: This was very helpful.

APPENDIX B. INTERVIEW

This is an interview between the IS3001 course instructor and the author. Names of individuals have been removed from this transcript. The interview as dictated from audio tape:

Facilitator (F): The questions that I will be asking will be similar to the questions I will be asking the focus group. Remember, these questions are fictional! What if there was an edict from "the Admiral" saying that all the NPS courses being taught must use at least two software packages that enhance student interactivity within the classroom? The teaching staff can chose what software packages are ideal for their course. For example, the instructors can use online conference, chat rooms, NetMeeting, e-mail, web forums, virtual reality, games, whiteboard collaboration where people can draw and erase stuff, to name a few.

Instructor (P): They (students) have some experience with web forums and e-mail. They probably don't know what NetMeeting is. Do you know what GSS is? It's kind of like a group expert system.

F: No.

P: It got really big for a while and it's not quite as big now. It's when executives get into a room with a big whiteboard. They all sit around in groupthink and enter their information and it comes up on the screen for everyone to read. Then, they can talk to each other. It is similar to a DSS.

F: Okay, I've heard of those types of systems. So what do you think about my initial question? Would it work, would it not work? It would be where everything needs to be completed by this spring quarter, by Jun.

P: What do you mean?

F: Would this type teaching environment work in the traditional classroom environment if the NPS totally changed all their courses over to include using two types of software applications to improve student interactivity?

P: Instead of the lecture?

F: No, as an addition to the lecture. Just like you did for your IS3001 course.

P: Well, I think, the addition of the forums, I found them really good. I like the forums. E-mail, everyone uses that so that's already a given. The NetMeeting and the whiteboards, I don't know if that would work so well, because the students would all have to be hooked up together at a certain time with enough bandwidth to use all that.

Then, they have to have the correct software on their computer. Especially for an intro course, setting up NetMeeting would probably be beyond the scope of some of the people, even forums and stuff at first.

F: What do you mean?

P: To show them how to use the software. Remember, there were people in my course who didn't know how to create a directory. I think it's a great thing to do though. To have the students learn that and get into that environment, because they are going to be in that environment out in the Fleet. So it's very good. In fact, this would be a great thing to add to my course, but I don't have the time for it. It would be great to be one of the early courses to you have here, setup NetMeeting between some people, show them now to use it with the whiteboards and things like that. So they could actually do it between themselves at night at their homes or something like that. Have meetings instead of going upstairs in library and using those rooms. They could do this. What's great about this if when they are a program manger for something in DC and talking to somebody in San Diego or Norfolk or somewhere, they could have their NetMeeting going. I think it would be great experience for them. So to do it here in a sterile environment would be a great experience and they could take this and know how to use it in the Fleet.

F: Looking at your expertise and then comparing it to other instructors who don't have a strong background to develop these forums or chat rooms and use all these different software packages, do you think it will go over well at the NPS when the Admiral says, it is the future, we're going to be doing this anyway?

P: First of all the Admiral really cannot make this edict.

F: I understand, but it's a hypothetical question.

P: I know that is a hypothetical question. What I'm trying to say here is doesn't matter if he's the Provost or whatever. Academia, especially tenured, people do what they want. If they decide that they are not going to do this, they won't do it. There's nothing you can do to make them do it. So you have to provide some type of incentive for them to do it. And frankly there's a lot you won't be able find who will be interested in the incentive. There are people who still did not hooked-into e-mail. So the Provost said we will require you to read e-mail, because we will use it for specific things and that's why we use it. So, yes, I think, we have a big, big problem using it with people who are not interested in it, who don't have the technological background and what you are touching on is distributed learning which is what we are working on and I happened to be on one of the initial committees here. One of the problems we are worried about is how does the instructor learn how to setup distributed learning. Forums are a perfect example. We have different software to do that. The simplest way is to use FrontPage 2000. That's what I use, but I don't think there is another instructor on campus who knows how to do that. But there are other things you can use for that. WebCT has it's own and there are many instructors who know how to do that and teaching how to use WebCt and

CourseInfo are both frameworks for distributed learning courses and that's what they are trying to teach the instructors. WebCT and CourseInfo are frameworks for the instructor to go in and just build the HTML pages for his class. Forms are already built in. So those are the frameworks that the school is using to build the first distributed learning courses. And there are many instructors who don't want to do it.

F: Do you know what their reasonings are, outside of what you just told me?

P: There is a lot of reasons. One is which one am I going to use. Telelogic – has the tow. CourseInfo – is right now the official framework for distributed learning on the campus, but WebCT may be in the near future, because the Navy may switch to that. So they don't want to learn something that may change. Plus, they have a fear that they may be teaching their courses online as well as teaching their courses in class and will be required more with the same amount of pay. Many more hours with the same amount of pay and there are a lot of instructors not interested in doing this. Plus, the instructors don't get the positive feedback online like the do in class. They really like the students here. They like the feedback from students. They don't get that feedback online and they find it's more work to teach a class online than to teach it is to teach in conventional lecture.

F: What if the school did the exact opposite where the instructors did not use the computer in the classroom, did not use e-mail and just instructed with a "big stick" kind of thing? What do you think?

P: There are instructors that already do that. Depends on the course like mathematics courses. They are having a really tough time trying to figure out distributed learning for mathematics courses, because some of the symbols, for instance, they haven't figured out how to put on web pages. You can make images of them obviously, but to use them like with Word and change it over to HTML, that's a difficult one to teach. So math is difficult. Lab oriented obvious stuff that I teach – when I have them in lab as a part of a network class and tear apart a computer – how do I do that online? Students love working in labs. They learn. They develop tacit knowledge faster, better than reading about it. For IT, there are people now who teach, like IS3502, a networking class. Some people teach that and you never touch anything. I taught it and I had them actually built a computer, the network, with parts with the theory of touching something. So there are different philosophies here. Some instructors think well George you're teaching them hand-ons where that's training and that's not education. Where education is understanding the theory behind it so that next year when it change they can still work with it. Where if I teach them Windows and then they want to learn Linux next year, how to hook-up a network in Linux and their point is well I taught them the theory better than you have to a point where they can make a transition to Linux operating system network easier than my style.

F: You brought up a valid point, which is how the instructor wants to teach the class, because I have had the class where you didn't touch anything for IS3502. But I knew what he was talking about because I touch it before.

P: You were lucky.

F: Right. But the other people, you could tell they were swimming. What in the world is he talking about? I've never seen that before. I can't picture that. I think, it is course dependent, but I think it is instructor dependent as well.

P: What you find, I think, is that older instructors who have never used computers. They haven't learned these things. They haven't used NetMeeting or they learned something their selves. See I've learned some great things using forums when I did my work at Sony and also when I was working on the school's telephone directory. I used the some forums to find out some answers to some questions. So I know how variable they are. For somebody who has not used a forum themselves how are they going to teach a student how to use these forums. They just don't think it is important, because they never used it, never seen the value of it.

F: As an instructor how could we get the all other instructors interested in using these types of software packages, where it's not offense to them and we are not forcing it "down their necks"?

P: First, there is always a core of people that want to learn something new. It doesn't matter what it is or what course it is, there will be people who want to use it for their course, whether it is space ops or mathematics. Then there is another group who have done it the same way for a long time and doesn't matter to them, because they do not want to change. Because they are doing a lot of research and this is the simplest way to teach the same way they've always done before. There is a big learning curve. It costs instructors money in reality to learn these techniques and that they get paid certain amount a term for a certain number of hours. If they have to spend 30% more time learning to use these techniques and get paid the same especially if it takes away from a research project where they are getting money or even consulting on the outside, they are not interested. So when I sitting here at night and I work for 4-5 hours to learn something new basically I'm not getting paid for it. You have to make it one incentive is just to keep up it - current technology and there is a lot of people who don't want to that. Two – if the school went toward that and said well we at the NPS have to have distributed learning because our sponsors want it and that's what our officers in the Fleet really need. We need to do that. They'll understand that and that's the incentive. But they all say you ought to train me. You just don't tell to use NetMeeting (or any other new software application). You have to train me on how to use it and you have to pay me to use it, because you can't expect me to teach an extra class or two for nothing. Unfortunately, that's what a lot them are thinking is happening to them. They are talking about having courses with 40 people in it for distributed learning. It takes more work per student so how much do I get paid for it? If they teach it for four months instead of three months,

do you get paid for that one section, especially if you have somebody that can go on the outside and they can get paid per hour? There is a financial incentive obviously. There has to be a financial incentive. There has to be education and training. There has to be a research incentive; they need that for their research; that is another incentive. Basically what I find in academia is you have to motivate the faculty and motivation is obviously individual motivation something they need to either they want to learn new technology, that's a motivation, but some others don't want to learn it. They maybe forced to do it or their pay must be dependent on it. If their course they teach goes to distributed learning, they either learn it or they don't teach. Now the distributed learning obviously some of the instructors are afraid of it, because they feel if the NPS puts a big emphasis on distributed learning then there will be no need for the NPS. Obviously most of the instructors and, I think, most of the students feel they learn more by being in the class from their instructor and the other students that's the major part of the learning curve. Distributed learning is not as rich in that part. Of course, the Navy, rightly so, says if I have a F14 pilot who is never going to come here, because he does not have the two years to come here. We can have him become more technologically by a distributed learning course if he is on ship or on a shore station that will help the Navy. Everyone understands that; it's a good argument. Will it be as rich? I don't know; I'm just starting this myself.

F: Probably not right now, but I bet it eventually will be especially if they fix the hardware issues like bandwidth.

P: There are some things you can have. For instance, when I was looking at my lab, showing the students different CPUs, we only had a certain number of CPUs because we had a certain number of motherboards. But I could put that up on a web pages and I could have a whole history of CPUs, motherboards, chip sets. I could show them all. Plus, links to learn more about them than time I have to talk about in class. So there are areas where it can be at least as rich as in class.

F: Well, that's a great lead-in. What types of software application do you think are more ideal for the traditional classroom environment? For distance learning maybe a website or a database with all these pictures, but for a traditional classroom, do you think you favor one software application over another or is it just maybe course dependent?

P: Personally, I think, web pages are great - just to put out there for explicit information about the course, put on the PowerPoint slides, put on the class schedule and put links to download, all that stuff. Students love that; it's really good. Plus, you save money. I only give my students one piece of paper a term, except for tests. That's all I give and that piece of paper is just the schedule and the name of the books. All it is is a copy of the web page that shows that and everything else on my course is on the web page. Web pages everyone understands that in HTML, web browser. I think, that's where everything starts from so, I think, everyone would think that's a good idea at this point. Where do you go from there now? I think, forums are a good thing, but as I found they are not an end-all. You have to work to make sure they work – they work better in a

discussion class where they discuss principles and things like having a class discussion. I think, that's a good way to do it. They can read about it and then discuss things. They can discuss theory and can have discussions on theoretical issues.

F: You don't think forums are good for what type of topic?

P: I think forums are good in general. In my class, it didn't work for programming though, because the students didn't see the benefit of it in the conventional class. They had me to ask and show what the problem was. Now, I think, NetMeeting is a great thing to teach them. They should be required to do that for a project.

F: NetMeeting can do multiple things like swapping files, share programs, chat, etc.

P: You can click on web pages' links to download files. NetMeeting is to talk back and forth. Forums are good. Obviously, as you start moving up and get snippets of audio and video, you can use these in web pages, NetMeeting and web forums. You can set up streaming video site on a steaming video server and it comes free with ISS 5.0. So you can set up streaming video. You can have your class on a website on streaming video. Any time they want to down that file, it's just a file, they take a MPEG file and create it from a camera and put it up. There is not interaction there.

F: I think we already touch upon this question – can computer mediated communications (CMC) be used in the classroom?

P: I think it's a definite plus.

F: The next question I have what can be changed, improved, or done differently in order to increase students' interactivity in learning the materials at the NPS?

P: I think, interactivity seems like in my classes obviously that I use the labs I force the interactivity. There are a lot of people who lecture. There's not much interactivity in their class. Forums can be used there for a lot of their interactivity where it would require people to discuss topics online. NetMeeting would be more for smaller projects. A lot of instructors do that in class. You have a project that can be done in the class period or outside of class and that's where you build your interactivity. You can use the forums for that concept.

F: What about during the class period? Your answer is more applicable to outside class.

P: One of the things for outside is to build simulations, models, things that you can use. For instance HTML, I didn't teach this in the last course. There wasn't enough time, but there is this place on the Internet where it teaches you the basics of HTML and allows them to put in codes, hit a button and shows them what the results are. I think that is interactive. In class interactivity, obviously labs are great. Simulation applications are great. Doing programming obviously is good. Interactivity amongst themselves, which

you don't need computers necessary to do that, where you sit down and work a problem. Writing code is tough to do as a group. Although it's great to see three to four students try to help somebody else get through some coding and they do that in the labs. So there is interactivity and of course the person teaching always learns how to teach and plus they learn something.

F: How much time did you take to develop this class, i.e. you web forums?

P: A lot. Really a lot.

F: Can you put a numerical figure to "a lot" in developing your web site and your forums in terms of time involvement?

P: Well, the forums are actually pretty simple. With the forums, I luckily had someone show me how to build the forums in FrontPage 2000 and I saw that as a great result, because I learned how to do them in two other areas, CourseInfo and Teleogic. I learned about the theory, saw how to do it and when I saw it in FrontPage 2000. Then I said, "Wow, this is pretty easy!". So maybe five hours to learn how to do it correctly. Then, couple more hours to set up the questions. Then, several hours to check students' inputs, but that was extra. That was beyond course. When I ask them questions about hardware that was beyond the book, all that was extra time I spend this time that I didn't spend last year on the course. I spent a lot of time on the web pages. I did updating from last year's course. I think, I changed the course 30% from last year. Just because it's IT (information technology) certainly, but then I spent a lot of time redesigning the home page. We just use the forums basically. We didn't have a lot of extra interactivity.

F: Any other comments you would like to make before we close this interview?

P: I have recommendations of questions to for you to ask my students during your focus group. I might get their inputs on what they think would be good on usage of CMC on campus. What courses they think might be good? Specifically like our labs we have, they had lots of points about how they really like hands-on lab of tearing the computer apart. They didn't see where I could duplicate that in any way. Where I thought that I could do better at that than I could on the programming part. Because I thought programming I could talk to them about it. I could put the assignment up on the web page. They could send me their code and I could review it and send it back to them, but I thought boy I going to lose a lot by not having class, doing the snippets of code. But the students thought well they would have to use the forums outside of class. They will have to send their code to me and they could interact directly with me. But they all said the instructor would have to work much, much harder, spend a lot more hours, in a distributive learning environment whether it's right here at the NPS or wherever. Distributive learning is always a time sink for the instructor. Instructors and facility are very aware of how many hours that people have to spend to build these courses. The first people here at the NPS, "space instructor" and "information warfare instructor", they worked for quarters to get these ready. And the initial courses cost the school a lot of

61

money. Not only on their time spent, but also Telelogic's time to set these courses up. The DLRC (Distributed Learning Resource Center) is the setup to support facility to build distributed learning courses. As of right now, they only have one-and-half people to help. That's going down to ½ person. Right now the only resource the faculty has for distributed learning is CourseInfo. On person at the NPS teaches CourseInfo to the faculty, which is good. Unless you have Telelogic obviously - they handhold you through, they help you. They hired-on a contractor that helped. For instance, this course for distributed learning, I needed these kinds of graphics, these kind of web pages for my distributed learning course. The NPS paid them a lot of money to go through the web to find stuff for me to use for the distributed learning. For instance, the CPU pictures – unfortunately this wasn't successful. Now we are using the NPS Library to help us to find these resources, but this is one step just finding the resources on the web to use. I spend hours and hours. When they gave me that, I spend about 20 hours looking through what they gave me to find out they were not useful. Just to find the right pages and a lot of the pages are behind firewalls so you can't get to them. So that was one part. The distributed learning resource center staff, DLRC, they are supposed to help you build the course. The faculty is the subject matter expert, which is fine and that's true, but then you have to find the resources to use for your class if you are going to be online, for pictures and you want these links to resources, that's the richness of being online. They're supposed to get that and you take that with your course material when you taught it normally. Then take that course material and these resources and somehow put it on it on the web. Now that's a totally different teaching environment from the lecture and we are struggling with – I spend a lot of time researching my PhD on knowledge transfer and things like that and not many people have. So you have the faculty member that says I know how to teach the course, you are going to give me these links and now I'm supposed to put it up on CourseInfo and I can't connect the dots. I know my stuff. I see where it is on the web, but to take what I have in my lecture notes and PowerPoint slides, I can slap it up on a web page, but that's not distributed learning. That's just web links to my web site. And that step while it is knowledge transfer, building tacit knowledge hasn't been taught to the faculty. All of us don't know how to do it well. That's one of the reasons the faculty doesn't want to do it. They don't want anything. They know they do well in class, but they don't know how to make it a distributed learning course, even if it is local.

F: So putting the information up on a website you are teaching explicitly, but you are not tacitly?

P: Well, there is the whole deal is of how do I take explicit knowledge and build tacit knowledge out of it. That is what knowledge transfer is. That's the whole transfer knowledge bailiwick. And you can't. You can do it for instance if I put explicit knowledge up. One of the things you have to use is that you still have to use your books. My book for my course, the Visual Basic, you have the programs. You have the simulations. So you tell them what chapters to read. Then, as the instructor, you have to write a book on the course. I take one sheet of paper into class, just for my outline. Then I talk for two hours. Well, you can't put that outline up on the network, because the

students won't get it. You have to write in a format that's readable your two-hour lecture on the network. That's what you have to do. Now there is some richness there; you can have links to different things they want. But you have to write a book about your course and you have to update it every term.

F: This is extremely consuming, I understand, especially from my research. You almost need to an entirely new professional group of people where that's their function.

P: That's what Telelogic does. They sit down with the instructor, here's my course material, here's this and then they start telling you the taxonomy of this and that and of cognitive learning. You have to know about cognitive learning. You have to know the size of a block, about the colors. So if you want to do that the faculty has to learn how to do that. Like I say to change the course from the PowerPoint slides with some notes into a book, who pays you to do that? But the theory is that once you've done that the course will be easier to teach in the long run. I don't buy that. With my course, I have to change a lot every term, because the technology changes. So there is a lot of rewriting, you have to change your book. Who is going to pay to change your course every year? So this is another thing that instructors think about.

F: These days it seems that the students are expecting more and more from their classes.

P: No matter what you have they will expect more and you will want to make it better.

F: Any other comments?

P: There is one thing we haven't talked about, but have you heard about virtual teams. Have you heard about that?

F: No.

P: I wanted to teach that as a part of this course, but I didn't have enough time. Virtual teams use some of this collaborative stuff that we've talked about, like NetMeeting and things like that. What I wanted to do is an experiment for knowledge transfer was to take a group of four students in my class and have them not come to class. Send e-mail out to all four of them. Tell them they were not allowed to meet physically and then give them a project to do. I would do this with different groups. First conduct a pre-test. Then you would have one group that can only use e-mail. Another group can only use NetMeeting. Another group would use another type of application only. Another group you may allow them to meet physically once a week and use all the other resources. Other things to do could be to have four people who don't know each other to complete a project and four people who do know each other. These are virtual teams. So you would get more into that using electronic stuff in the project. Virtual teams are a reality. That's how people do projects in real world. There is an example in the knowledge management literature about how a virtual team set up to solve a problem in the North Sea on an oil rig. There is a problem with some drill bit and it was potentially really dangerous and it

could have been catastrophic. They were worried about wiping out and killing a bunch of people, because it was getting these certain vibrations, but they had to go further and deeper. So they actually brought it and they got a virtual team together within a couple of hours across the world to discuss this. They actually brought the drill bit up in the camera to the computer. They all looked at it and made a decision on how to fix it and they fixed it successfully. That's one of the examples of virtual teams. You can do this with airplanes, etc. So if you were on an aircraft carrier and you didn't know how to fix a part, but there is somebody back in Norfolk at the next level, they could walk you through it. That's a virtual team. Pushing bandwidth.

F: Bandwidth is what's hurting us now. It will come soon, I guess.

P: It will come, but you'll always need more. It's never enough. Once everyone starts using the new technology, like DSL, then we're back to where we are today, wanting more bandwidth.

LIST OF REFERENCES

Aberson, C. L., D. E. Berger, E. P. Emerson and V. L. Romero (1997) WISE: Web Interface for Statistics Education. *Behavior Research Methods, Instruments and Computers*, 29(2).

Ahern, T. C., K. Peck and M. Laycock (1992) The Effects of Teacher Disclosure in Computer-Mediated Discussion. *Journal of Educational Computing Research*, 8.

Allen, R. L., J. T. Bowen, S. Clabaugh, B. B. DeWitt, J. Francis, J. P. Kerstetter and D. A. Rieck (1996) *Classroom Design Manual*, 3rd Edition. College Park, Maryland: University of Maryland.

Anderson, M. D. (1996) Using Computer-mediated Conferencing to Facilitate Group Projects in an Educational Psychology Course. *Behavior Research Methods, Instruments and Computers*, 28.

Anderson, A., J. T. Mayes and M. R. Kibby (1995) Small Group Collaborative Discovery Learning from Hypertext. In C. O'Malley (Ed.), *Computer Supported Collaborative Learning*. New York: Springer-Verlag.

Alavi, M. (1994) Computer-mediated Collaborative Learning: An Empirical Evaluation. *MIS Quarterly*.

Azevedo, R. (1995) A Meta-Analysis of the Effects of Feedback in Computer-Based Instruction. *Journal of Educational Computing Research*, 13(2).

Barker, T. and F. Kemp (1990) Network Theory: A Postmodern Pedagogy for the Writing Classroom. In C. Handa (Ed.), *Computers and Community: Teaching Composition in the Twenty-first Century*. Portsmouth, New Hampshire: Heinemann.

Barson, J., J. Frommer and M. Schwartz (1993) Foreign Language Learning Using E-mail in a Task-oriented Perspective: Interuniversity Experiments in Communication and Collaboration. *Journal of Science Education Technology*, 4(2).

Bates, R. A., E. F. Holton, III and L. Seyler (1996) Principles of CBI design and the Adult Learner: The Need for Further Research. *Performance Improvement Quarterly*, 9(2).

Batson, T. (1988) The ENFI Project: A Networked Classroom Approach to Writing Instruction. *Academic Computing*, 2(5).

Berge, Z. L. (1995). Facilitating Computer Conferencing: Recommendations from the Field. *Educational Technology*, 35.

Berge, Z. L. and M. P. Collins (1995) Overview and Perspectives. In Z. L. Berge and M. P. Collins (Eds.), *Computer-mediated Communications and the Online Classroom (Vol. 1)*. Creskill, New Jersey: Hampton Press.

Boiarsky, C. (1990) Computers in the Classroom: The Instruction, the Mess, the Noise, the Writing. In C. Handa (Ed.), *Computers and Community: Teaching Composition in the Twenty-first Century*. Portsmouth, New Hampshire: Heinemann.

Boyle, T. (1997) *Design for Multimedia Learning*. London: Prentice-Hall Europe.

Brandon, D. P. and A. B. Hollingshead (1999) Collaborative Learning and Computer-supported Groups. *Communication Education*, 48(2).

Brooksfield, S. (1987) *Developing Critical Thinkers*. San Francisco: Jossey-Bass.

Brown, J., A. Collins and P. Duguid (1989) Situated Cognition and the Culture of Learning. *Educational Researcher*, 18.

Chesebro, J. W. and D. G. Bonsall (1989) *Computer-mediated Communication: Human Relationships in a Computerized World*. Tuscaloosa, Alabama: The University of Alabama Press.

Cifuentes, L. and K. Murphy (2000) Cultural Connections: A Model for Eliminating Boundaries and Crossing Borders. *Quarterly Review of Distance Education*, 1(1).

Clark, R. E. (1983) Reconsidering Research on Learning from Media. *Review of Educational Research*, 53(4).

Cohen, M. and N. Miyake (1986) A Worldwide Intercultural Network: Exploring Electronic Messaging for Instruction. *Instruction Science*, 15.

Comprehensive Facilities Planning, Inc. (2000) Naval Postgraduate School Classroom and Assessment Final Report.

Cummins, S. and D. Sayers (1990) Education 2001: Learning Networks and Education Reform. *Computers in Schools*, 7(1/2).

Davies, D. (1995) Learning Network Design: Coordinating Group Interactions in Formal Learning Environments Over Time and Distance. In C. O'Malley (Ed.), *Computer Supported Collaborative Learning*. New York: Springer-Verlag.

Derycke, A. C. and C. D'Halluin (1995) Co-operative Learning in the Distance Education of Adults: Why, How, and First Results from the Co-learn Project. In B. Collis and G.

Davies (Eds.), *Innovative Adult Learning with Innovative Technologies*. New York: Elsevier.

D'souza, P. V. (1991) The Use of Electronic Mail as an Instructional Aid: An Exploratory Study. *Journal of Computer-Based Instruction*, 18.

D'souza, P. V. (1992) Electronic Mail in Academic Settings: A Multipurpose Communication Tool. *Educational Technology*, 32(3).

Duderstadt, J. A. (2000) *A University for the 21st Century*. Ann Arbor: The University of Michigan Press.

Eldred, J. (1991) Pedagogy in the Computer-networked Classroom. *Computers and Compositions*, 8(2).

Faigley, L. (1990) Subverting the Electronic Workbook: Teaching Writing Using Networked Computers. In D. Baker and M. Monenberg (Eds.), *The Writing Teacher as Researcher: Essays in the Theory and Practice of Class-based Research*. Portsmouth, New Hampshire: Heinemann.

Flynn, J. P (1987) Simulating Policy Processes through Electronic Mail. *Computers in Human Services*, 2(112).

Finholt, T., S. Kiesler and L. Sproull (1986) *An Electronic Classroom*. Working paper, Carnegie Mellon University, Pittsburgh, Pennsylvania.

Folaron, G. (1995) Enhancing Teaming with E-mail. *Journal of Teaching in Social Work*, 12(1/2).

Freiere, P. (1970) *Pedagogy of the Oppressed*. New York: Seabury.

Garrison, D. R. and M. Baynton (1987) Beyond Independence in Distance Education: The Concept of Control. *American Journal of Distance Education*, 1(3).

Gay, G. and M. Lentini (1995) Use of Collaborative Resources in a Networked Collaborative Design Environment. *Journal of Computer-Mediated Communication*, 1.

Gayeski, D. M. (1997) *Designing and Managing Computer Mediated Learning: An Interactive Toolkit*. 3rd Edition. Ithaca, New York: OmniCom Associates.

Goodwin, C. and J. Heritage (1986) Conversation Analysis. *Annual Review of Anthropology*, 19.

Harasim, L. (1986) Computer Learning Networks: Educational Applications of Computer Conferencing. *Journal of Distance Education*, 1(1).

Harasim, L. (1991) Teaching by Computer Conferencing. In A.J. Miller (Ed.), Applications of Computer Conferencing to Teacher Education and Human Resource Development. Symposium conducted at the meeting of the International Symposium on Computer Conferencing, Columbus, Ohio. (ERIC Document Reproduction Service No. ED 337 705).

Hartman, K., C. Neuwirth, S. Kiesler, L. Sproull, C. Cochran, M. Palmquist and D. Zubrow (1991) Patterns of Social Interaction and Learning to Write: Some Effects of Network Technologies. *Written Communications*, 8(1).

Hefzallah, I. M. (1999) *The New Educational Technologies and Learning: Empowering Teachers to Teach and Students to Learn in the Information Age.* Springfield, Illinois: Charles C. Thomas Publisher, Ltd.

Hiltz, S. R. (1990) Collaborative Learning: The Virtual Classroom Approach. *THE J*, June.

Holmberg, B. (1989) *Theroy and Practice of Distance Education.* London: Routledge.

Hooper, S. (1992). Cooperative Learning and Computer-based Instruction. *Educational Technology, Research, and Development*, 40.

IS3001 Computer and Software Technology Syllabus (2000).

Johnson, M. M. and M. T. Huff (2000) Students' Use of Computer-mediated Communication in a distance education course. *Research on Social Work Practice*, 10(4).

Johnson, D. W., R. T. Johnson and K. A. Smith (1991) Cooperative Learning: Increasing College Faculty Instructional Productivity (ASHE-ERIC Higher Education Report No. 4). Washington, District of Columbia: The George Washington University School of Education and Human Development. (ERIC Document Reproduction Service No. ED 343 465)

Karayan, S. and J. Crowe (1997) Student Perceptions of Electronic Discussion Groups. *Technological Horizons in Education*, 24(9).

Kern, R. (1993) Restructuring Classroom Interaction with Networked Computers: Effects of Quality and Characteristics of Language Production. Paper delivered at ACTFL, 1993, San Antonio, Texas.

King, K. M. (1994) Leading Classroom Discussions: Using Computers for a New Approach. *Teaching Sociology*, 22.

Kinkead, J. (1987) Computer Conversations: E-mail and Writing Instruction. *College Composition Communications*, 38(3).

Knowles, M. (1990) *The Adult Learner: A Neglected Species*, 4th Edition. Houston: Gulf.

Kroonenberg, N. (1995) Developing Communicative and Thinking Skills via E-mail. *TESOL Journal*, 4(2).

Latting, J. K. (1994) Diffusion of Computer-mediated Communication in a Graduate Social Work Class: Lessons from "The Class from Hell." *Computers in Human Services*, 10(3).

Mabrito, M. (1991) Electronic Mail as a Vehicle for Peer Response. *Written Communications*, 8(4).

McComb, M. (1993) Augmenting a Group Discussion Course with Computer Mediated Communication in a Small College Setting. *Interpersonal Computer Technology*, 1(3).

Meyers, C. and T. Jones (1993) *Promoting Active Learning: Strategies for the College Classroom*. San Francisco: Jossey-Bass.

Moore, M. (1989) Three Types of Interaction. *American Journal of Distance Education*, 3(2).

Morrison, G. R., S. M. Ross, M. Gopalakrishnan and J. Casey (1995) The Effects of Feedback and Incentives on Achievement in Computer-based Instruction. *Contemporary Educational Psychology*, 20(I).

Murray, D. (1991) The Composing Process for Computer Conversation. *Written Communications*, 8.

O'Donnell, A. M. and J. O'Kelly (1994) Learning from Peers: Beyond the Rhetoric of Positive Results. *Educational Psychology Review*, 6.

Pea, R. D. (1994) Seeing What We Build Together: Distributed Multimedia Learning Environments for Transformative Communications. *The Journal of the Learning Sciences*, 3.

Phillips, G., G. Santoro and S. Kuehn (1988) The Use of Computer-mediated Communication in Training Students in Group Problem-solving and Decision-making Techniques. *American Journal of Distance Education*, 2(1).

Piaget, J. (1983) Piaget's Theory. In P. Mussen (Ed.) *Handbook of Child Psychology*. Wiley.

Pratt, E. and N. Sullivan (1994) Comparison of ESL Writers in Networked and Regular Classrooms. Paper presented at TESOL '94, Baltimore, Maryland.

Resnick, L. (1988) Learning in School and Out. *Educational Researcher*, 16(9).

Rogers, E. M. (1983) *Diffusion of innovations*, 3rd Edition. New York: Free Press.

Roschelle, J. (1992) Learning by Collaborating: Convergent Conceptual Change. *The Journal of the Learning Sciences*, 2.

Roschelle, J. and S. Teasley (1995) The Construction of Shared Knowledge in Collaborative Problem Solving. In C. O'Malley (Ed.), *Computer Supported Collaborative Learning*. New York: Springer-Verlag.

Ross, J. A. (1996) The Influence of Computer Communication Skills on Participation in a Computer Conferencing Course. *Journal of Educational Computing Research*, 15(1).

Ruberg, L. F., D. M. Moore and C. D. Taylor (1996) Student Participation, Interaction, and Regulation in a Computer-mediated Communication Environment: A Qualitative Study. *Journal of Educational Computing Research*, 14(3).

Salaberry, M. R. (1996) A Theoretical Foundation for the Development of Pedagogical Tasks in Computer Mediated Communication. *CALICO Journal*, 14.

Scardamalia, M. and C. Bereiter (1996) Student Communities for the Advancement of Knowledge. *Communications of the ACM*, 39.

Schramm, W. (1977) *Big Media Little Media*. Beverly Hills: Sage Publications.

Selfe, C. (1990) Technology in English Classroom: Computers through the Lens of Feminist Theory. In C. Handa (Ed.), *Computers and Community: Teaching Composition in the Twenty-first Century*. Portsmouth, New Hampshire: Heinemann.

Selfe, C. and P. Meyer (1991) Testing Claims for On-line Conferences. *Written Communications*, 8(2).

Simonson, M., S. Smaldino, M. Albright and S. Zvacek (2000) *Teaching and Learning at a Distance: Foundations of Distance Education*. Upper Saddle River, New Jersey: Prentice-Hall, Inc.

Slavin, R. E. (1991) Synthesis of Research on Cooperative Learning. *Educational Leadership*, 48.

Sliwa, S. (1994) Re-engineering the Learning Process with Information Technology. *Academe*, 80.

Sproull, L. and S. Kiesler (1991) *Connections: New Ways of Working in the Networked Organization*. Cambridge, Massachusetts: MIT Press.

Stocks, J. T. and P. P. Freddolino (2000) Enhancing Computer-mediated Teaching through Interactivity: The Second Iteration of a World Wide Web-based Graduate Social Work Course. *Research on Social Work Practice*, 10(4).

Svanum, S., S. H. A. Chen and S. Bublitz (1997) Internet-based Instruction of the Principles of Base Rate and Prediction: A Demonstration Project. *Behavior Research Methods, Instruments and Computers*, 29(2).

Tella, S. (1992) *Boys, Girls, and E-Mail: A Case Study in Finnish Senior Secondary Schools*. Research Report No. 110, Helsinki: Dept. of Teacher Education, University of Helsinki.

Vertegaal, R. (1999) The GAZE Groupware System: Mediating Joint Attention in Multiparty Communication and Collaboration. *Proceedings of the CHI 99*. New York: ACM.

Vygotsky, L. S. (1978) *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, Massachusetts: Harvard University.

Waggoner, M. (1992) A Case Study Approach to Evaluation of Computer Conferencing. In A. R. Kaye (Ed.), *Collaborative Learning through Computer Conferencing*. New York: Springer-Verlag.

Warschauer, M., L. Turbee and B. Roberts (1996) Computer Learning Networks and Student Empowerment. *Systems*, 24(1).

Wilson, B.G. (Ed.) (1996) *Constructivist Learning Environments: Case Studies in Instructional Design*. Englewood Cliffs, New Jersey: Educational Technology.

Witmer, D. F. (1998) Introduction to Computer-mediated Communication: A Master Syllabus for Teaching Communication Technology. *Communication Education*, 47.

Wolz, U., J. Palme, P. Anderson, Z. Chen, J. Dunne, G. Karlsson, A. Laribi, S. Mannikko, R. Spielvogel and H. Walker (1997) Computer-mediated Communication in Collaborative Educational Settings. Working Group Reports and Supplemental Proceedings. SIGCSE/SIGCUE ITiCSE 1997.

THIS PAGE INTENTIONALLY LEFT BLANK

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center...2
   8725 John J. Kingman Road, Suite 0944
   Ft. Belvoir, Virginia 22060-6218

2. Dudley Knox Library..2
   Naval Postgraduate School
   411 Dyer Road
   Monterey, California 93943-5101

3. LT Michele L. Ruppert, USN 1
   1417 Orkney Drive
   Leesburg, Florida 34788

4. Douglas E. Brinkley..1
   School of Business and Public Policy
   Naval Post Graduate School
   411 Dyer Road
   Monterey, California 93943-5101

5. Dr. William J. Haga 1
   School of Business and Public Policy
   Naval Postgraduate School
   411 Dyer Road
   Monterey, California 93943-5101

6. John and Edwina Ruppert...1
   1417 Orkney Drive
   Leesburg, Florida 34788

7. Dr. Aaron A. Velasco...1
   105 Calle Don Jose
   Santa Fe, New Mexico 87501

8. Chair, Code IS...1
   Naval Post Graduate School
   411 Dyer Road
   Monterey, California 93943-5101